TAXONOMY OF PLANT AND SOIL NEMATODES

ABSTRACT

THESIS SUBMITTED FOR THE DEGREE OF

Doctor of Science

IN

ZOOLOGY

ALIGARH MUSLIM UNIVERSITY, ALIGARH (INDIA)

BY

QAISER H. BAQRI

Ph. D.

Zoological Survey of India, Calcutta

July, 1987

The present thesis incorporates results obtained by the present author on his research on the taxonomy of plant and soil nematodes since January,1966. Though it is based mainly on the materials collected in India, studies on nematodes from other countries have also been included, especially from the Republic of Zaire. The contents of the thesis fall under three Orders: Tylenchida, Dorylaimida and Mononchida. However, a few species of other Orders have also been described. During the course of study, over one hundred new taxa have been described and 29 new combinations of species proposed. The descriptions of new taxa also include proposals of five new genera and two new subfamilies. The relationships of many closely related genera have been discussed and their diagnoses emended. Wherever necessary, identification keys to species have been provided. Allometric and morphometric variations of some commonly found species of economic importance have also been discussed. The study of variability of a number of species has led to the synonymy of many species.

The Order Tylenchida is represented in the thesis by 69 species belonging to 27 genera and 12 families, of which 12 species are described as new. A new genus Indoditylenchus has been proposed. Keys to genera of Tylenchorhynchus Cobb, 1913 and Hoplolaimus Daday, 1905 have been prepared. Intraspecific variations have been studied in the following species: Tylenchorhynchus mashhoodi Siddiqi & Basir, 1969; Tylenchorhynchus goffarti

Sturhan, 1966; Helicotylenchus dihystera (Cobb, 1893) Sher,1961; Helicotylenchus crenacauda Sher, 1966; Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963; Hirschmanniella oryzae (v.Breda de Haan, 1902) Luc & Goodey, 1963; and Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958.

A large number of species belonging to 16 families and 59 genera of Dorylaimida have been reported in the present thesis. Out of 201 species, 76 are described as new. In addition, the following four new genera and two new subfamilies have been proposed: Willinema Baqri & Jairajpuri, 1967; Morasia Baqri & Jairajpuri, 1968; Jairajpuria Baqri & Jana, 1980; and Medalinema Baqri & Jana, 1980; Neoactonolaiminae Baqri, Coomans and van der Heiden, 1975; and Medalinematinae Baqri & Jana, 1980. The identification of dorylaim species described by Shuurmans Stekhovan & Teunissen (1938), Shuurmans Stekhoven (1944) and Khera (1970) have been revised and as a result many new combinations have been proposed. The males of the following four known species have been described for the first time: Thornenema baldum (Thorne, 1939) Andrássy, 1959; Laimydorus finalis Thorne, 1975; Dorylaimoides arcuatus Siddiqi, 1964; and Paralongidorus citri (Siddiqi, 1959) Siddiqi, Hooper & Khan, 1963. Keys to the species of the following genera have been provided: Pungentus Thorne & Swanger, 1936; Thornenema Andrássy, 1959; Discolaimium Thorne, 1939, Aporcelaimellus Heyns, 1965; Dorylaimoides Thorne & Swanger, 1936; Enchodelus Thorne, 1939; and Laimydorus Siddiqi, 1969.

A paper discussing the various morphological characters of taxonomic importance was prepared so that it may serve as a guide line to those working on the taxonomy of dorylaims. During the revisionary study of the family Thornenematidae, the type species of the genus Indodorylaimus Ali & Prabha, 1974 was found misidentified. Hence, an application was sent to the Commission on the Zoological Nomenclature proposing a new name for the specimens described by Ali & Prabha. Despite objections raised by Siddiqi (1982), the majority opinion supported the present author.

The present thesis includes report on 22 species belonging to 11 genera and 6 families of the Order Mononchida. Four of these are new to science. The male of Anatonchus ginglymodontus Mulvey, 1961 has been recorded for the first time. A paper on the locations of the oesophageal gland nuclei and their orifices in different species of Mononchida also was prepared and is added to this thesis.

The diagnosis of the genus Tridontus Khera, 1965 under the family Diplogstridae, Order Diplogastrida is emended and the genus Syedella Suryawanshi, 1971 is declared a synonym of the former. Two new species from the mangrove environment of the deltaic Sunderbans, West Bengal, India are described under the families Anaplostomatidae and Oxystominidae.

The object of these surveys was to identify the nematodes and also to find out the key and potential pests of the crops

in West Bengal. The results of the qualitative and quantitative studies on the plant parasitic nematodes from different districts of West Bengal, India have revealed that Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963; Meloidogyne graminicola Golden & Birchfield, 1965; Helicotylenchus spp. and Tylenchorhynchus spp. are important pests of paddy in this region. After random survey conducted in three districts of Sikkim for the nematodes associated with citrus, it has been found that Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958 is a key pest on this plant.

Since Hirschmanniella gracilis is reported as a key pest of paddy in West Bengal, the following three field experiments were conducted on this species: seasonal variations in the population, estimation of crop losses, and effect of different sources of nitrogen. The results obtained are appended as supplement to the present thesis.

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Dated 21.7.1987

This is to certify that the thesis entitled "Taxonomy of plant and soil nematodes" embodies the research work done by Dr. Qaiser H. Baqri either singly or in collaboration with other scientists. The entire work is original and a significant contribution to the field of Nematology. The major portion of the work has been done by Dr. Baqri as is evident from the fact that out of 67 papers included in the thesis, he is either single or first author in 43 of them.

Dr. Baqri has spent over 20 years in research on nematode taxonomy. I have had the pleasure of watching him closely from his early days as a research student till date when he has blossomed into an experienced scientist of international repute. He has always worked with sincere devotion, perseverance and far-sightedness. On whatever topics he chose to work, the study was always done in-depth and with precision. His research publications have appeared in some leading journals of the world (Nematologica, Proc. helminth. Soc. Wash., Ann. Zool. Ecol. Anim., Revista brazil Biol., etc.) which speak of the high caliber of his work.

I have, therefore, allowed Dr. Qaiser H. Baqri to submit the present work in fulfilment of the requirements for the Degree of Doctor of Science in Zoology of the Aligarh Muslim University, Aligarh.

M. Shamim Jairajpuri

Chairman
Department of Zoology
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ACKNOWLEDGEMENTS

I am deeply indebted to Professor M. Shamim Jairajpuri who trained me in Nematology and supervised my research work for the Ph.D. degree. Without his constant help and encouragement it would have been difficult for me to prepare this thesis. Sincere thanks are also due to Professor A. Coomans, Rijksuniversiteit, Gent for his supervision and collaboration in research work during the period I was in Belgium.

I am grateful to Professor Athar M. Siddiqi, Chairman, Department of Zoology, Aligarh Muslim University and Dr. B.S. Lamba, Director, Zoological Survey of India, Calcutta for providing research facilities.

The collaboration in some research papers by Drs. S. Baqri, A. Van der Heiden, S. Ahmad, A. Jana, S. Khera, N. Ahmad, P.K. Das, Mrs. S. Dey, Miss R. Bakshi, Miss B. Sinha and Mr. S. Ghosh is also gratefully acknowledged.

I shall be failing in my duties if I do not thank Drs. Irfan Ahmad, Wasim Ahmad, A.L. Bilgrami, Mr. Tariq M.Khan, Miss Samina Shafaqat, Mrs. Gulsia Tehsin and Mr. Naved Sabir of the Nematology Research Laboratory at AMU Aligarh, who rendered valuable help and support during the preparation of the present work.

C O N T E N T S

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SUPPLEMENT

DECLARATION UNDER CHAPTER XXVI OF THE ACADEMIC ORDINANCES
ALIGARH MUSLIM UNIVERSITY, ALIGARH.

I. As required unier chapter XXVI of the Acaiemic Ordinances, Aligarh Muslim University, I declare that the major portion of the work presented in the thesis entitled "Taxonomy of Plant and Soil Nematodes" submitted to the Aligarh Muslim University, for the award of the degree of Doctor of Science, is an original contribution made by the author. In all, 67 papers have been incorporated in the thesis. These are as follows:

i) Papers published independently 10

ii) Papers with senior authorship ... 33

iii) Papers with junior authorship ... 24

The above papers have been classified hereunier. The titles of the papers have been omitted to save space. However, a list of publications by the author giving full details is appended at the end of the thesis on page 860.

(i) PAPERS PUBLISHED INDEPENDENTLY

1. Indian J. Nematol. 8 : 116-121, 1979
2. Bull. zool. Surv. India 2 : 139-143, 1980
3. J. Zool. Soc. India 33 : 141-148, 1982
4. Bull. zool. Nom. 39 : 57-68, 1982
5. Bull. zool. Nom. 39 : 285, 1982
6. Bull. zool. Nom. 41 : 137-138, 1984
7. Proc. 6th All India Cong. Zool., Abst. 21A, 1984

8. Proc. 3rd Natn. Conv. Helminth. India, Abst. 14, 1985

9. Bull. zool. Surv. India, 7 : 371-384, 1986

10. Unpublished : Nematodes associated with citrus from Sikkim (Monograph)

(11) PAPERS WITH SENIOR AUTHORSHIP

The name(s) of junior author(s) is/are given in parenthesis.

1. Nematologica 13 : 353-366, 1967 (M.S. Jairajpuri)

2. J. Helminth. 42 : 243-256, 1968 (M.S. Jairajpuri)

3. Nematologica 14 : 300-310, 1968 (M.S. Jairajpuri)

4. Nematologica 14 : 592, 1968 (M.S. Jairajpuri)

5. Nematologica 15 : 408-424, 1968 (M.S. Jairajpuri)

6. Ann. Zool. Ecol. anim. 1 : 327-337, 1969 (M.S. Jairajpuri)

7. Rev. Brasil. Biol. 30 : 61-68, 1970 (M.S. Jairajpuri)

8. Foundation pour favoriser les recherches scientifiques en Afrique. Bruxelles, 102 : 1-57, 1973 (A. Coomans).

9. Nematologica 20 : 131-146, 1974 (M.S. Jairajpuri)

10. Rev. Zool. afr. 89 : 967-986, 1975 (A. Coomans & A. van der Heiden)

11. Dr. B. S. Chauhan Comm. Vol. 171-180, 1975 (S. Khera)

12. Nematologica 22 : 424-432, 1976 (S. Khera)

13. Proc. zool. Soc. Calcutta 28 : 51-54, 1976 (S. Khera)

14. Rec. zool. Surv. India 73 : 1-11, 1977 (S. Khera)

15. Indian J. Nematol. 5 : 185-188, 1977 (M.S. Jairajpuri)

16. Newsl. zool. Surv. India 3 : 78-80, 1977 (S. Khera)

17. Nematologica 24 : 436-444, 1978 (S. Baqri & M.S. Jairajpuri)

18. Rec. zool. Surv. India 75 : 247-254, 1979 (S. Khera)

19. J. Zool. Soc. India 27 : 93-100, 1979 (M.S. Jairajpuri)

20. Nematologica 26 : 83-107, 1980 (A. Jana)

21. Bull. zool. Surv. India 3 : 237-247, 1981 (N. Ahmad)

22. Bull. zool. Surv. India 4 : 37-39, 1981 (M.S. Jairajpuri)

23. Bull. zool. Surv. India 4 : 209-211, 1981 (P.K. Das & N. Ahmad)

24. Nematologica 28 : 198-205, 1982 (A. Jana)

25. Rec. zool. Surv. India 80 : 331-340, 1983 (A. Jana, N. Ahmad & P.K. Das)

26. Rec. zool. Surv. India 80 : 341-354, 1983 (S.Z. Baqri)

27. J. Zool. Soc. India 35 : 29-48, 1983 (N. Ahmad)

28. Indian J. Nematol. 15 : 134, 1985 (A. Coomans)

29. Indian J. Helminth. (n.s.) 3 : 11-20, 1986 (A. Jana)

30. Unpublished : Nematoles from West Bengal (India) XIX .... West Dinajpur district (S. Dey)

31. Unpublished : Nematoles from West Bengal (India) XXIII .... Darjeeling district (S. Dey)

32. Unpublished : Nematoles from West Bengal (India) XXIV .... Coochbehar district (S. Dey & N. Ahmad)

33. Unpublished : Effect of different sources of nitrogen on the management of Hirschmanniella gracilis ..... (S. Dey & S. Ghosh)

(iii) PAPERS WITH JUNIOR AUTHORSHIP

The name of the other author(s) given in parenthesis

1. Nematologica 12 : 396-402, 1966 (M.S. Jairajpuri)

2. Nematologica 14 : 217-222, 1968 (M.S. Jairajpuri)

3. Proc. Helminth. Soc. Wash. 39 : 118-128, 1972 (A. Coomans)
4. Indian J. Nematol. 2 : 21-24, 1972 (M.S. Jairajpuri & S. Ahmad)
5. Nematologica 19 : 19-30, 1973 (M.S. Jairajpuri)
6. Nematologica 19 : 69-74, 1973 (M.S. Jairajpuri & S. Ahmad)
7. Newsl. zool. Surv. India 3 : 353-354, 1977 (A. Jana)
8. Rev. Zool. afr. 92 : 711-722 (M.M. Mulk & A. Coomans)
9. Bull. zool. Surv. India 3 : 221-225, 1981 (A. Jana)
10. J. Zool. Soc. India 33 : 1-24, 1982 (A. Jana)
11. Indian J. Nematol. 12 : 263-271, 1983 (A. Jana)
12. Bull. zool. Surv. India 5 : 85-91, 1984 (N. Ahmad & P.K. Das)
13. Bull. zool. Surv. India 6 : 75-79, 1984 (A. Jana)
14. Indian J. Helminth. (n.s.) 1 : 17-25, 1984 (P.K. Das & N. Ahmad)
15. Indian J. Helminth. (n.s.) 2 : 31-35, 1985 (B. Sinha & A. Choudhury)
16. Indian J. Helminth. (n.s.) 2 : 71-80, 1985 (S. Dey)
17. Bull. zool. Surv. India 7 : 199-202, 1986 (R. Baski)
18. Bull. zool. Surv. India 7 : 297-304, 1986 (A. Jana)
19. Unpublished : Species of the genus Xiphinema (N. Ahmad)
20. Unpublished : Halalaimus sagarensis n. sp. .....
..... (B. Sinha & A. Choudhury)
21. Unpublished : Studies on the species of subfamily Tylenchorhynchinae ..... (N. Ahmad)
22. Unpublished : Five new species of Dorylaimoidea (S. Dey)
23. Unpublished : Morphometric and allometric variations in Hirschmanniella oryzae ..... (S. Dey).
24. Unpublished : Anoplostoma macrospiculum n. sp. .....
..... (B. Sinha & A. Choudhury)

II I further declare that the following portion of the work submitted herein was previously considered for the award of Ph.D. degree of the Aligarh Muslim University. The degree was awarded in the year 1969 on my thesis entitled, "Studies on the nematodes associated with fibrous crops in India".

i) Descriptions of new species :

Sectonema procta, Pungentus angulatus, Willinema indicum, Discolaimium mazhari, Discolaimium upum, Aporcelaimellus heynsi, Aporcelaimellus indicus, Amphidelus novus, Lentonchus capitatus, Tylenchorhynchus hexincisus, Telotylenchus historicus, Dorylaimellus jacobi, Dorylaimellus deviatus, Morasia dimorphicauda, Dorylaimoides arcuicaudatus, Dorylaimoides saueri, Tylenchus (Clavilenchus) ritteri, Telotylenchus aerolatus and Discolaimium mukhtarpuriensis.

ii) Proposal of new genera :

Willinema and Morasia.

iii) Proposal of new combinations :

Thornenema mauritianum, Willinema parvum, Morasia rhabdotus.

iv) Males recorded for the first time :

Thornenema baldum, Dorylaimoides arcuatus and Dorylaimoides paratares.

v) Records of known species :

Tylenchorhynchus mashhoodi, Tylenchorhynchus martini, Tylenchorhynchus goffarti, Thornenema baldum, Thornenema

mauritianum, *Dorylaimellus longicaudatus*, *Dorylaimellus discocephalus*, *Dorylaimellus indicus*, *Dorylaimellus vexator*, *Belondira paraclava*, *Oxydirus oxycephalus*, *Oxydirus gigas*, *Oxydirus magnus*, *Dorylaimoides parateres*, *Dorylaimoides arcuatus*, *Discolaimium bulbiferum*.

vi) In addition, the Ph.D. thesis also included a list of nematode species associated with fibrous crops in Uttar Pradesh (India). *J. Zool. Soc. India* 27 : 93-100, 1979.

The following is the list of papers based on Ph.D. thesis:

1. *Nematologica* 12 : 396-402, 1966
2. *Nematologica* 13 : 353-366, 1967
3. *J. Helminth.* 42 : 243-256, 1968
4. *Nematologica* 14 : 217-222, 1968
5. *Nematologica* 14 : 300-310, 1968
6. *Nematologica* 14 : 592, 1968
7. *Nematologica* 15 : 408-424, 1969
8. *Ann. Zool. Ecol. anim.* 1 : 327-337, 1969
9. *Rev. Brasil. Biol.* 30 : 61-68, 1970
10. *J. Zool. Soc. India* 27 : 93-100, 1979

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INTRODUCTION

Nematodes are one of the most important and highly diversified groups of multicellular invertebrate animals. Like bacteria, viruses and insects they are found in all kinds of habitat. Most species are free living in soil, salt and fresh waters, while others live as parasites of animals and plants. Cobb (1914) has opined, "... if all the matters in the universe except the nematodes were swept away, our world would still be dimly recognisable ..... we would find its mountains, hills, valleys, rivers, lakes and oceans represented by a film of nematodes". According to him, every species of vertebrate is infested usually with two species of nematodes. Since we have about 50,000 species of vertebrates, they should harbour some 100,000 species of nematodes. If we add to this the nematodes associated with invertebrates, plants and those living in soil and waters, it would perhaps be fair to estimate about 500,000 species of nematodes in this world. Out of this huge number, only about 15,000 are known to science till date. Hence, we have so far explored hardly 3.3% of the nematode fauna.

Our knowledge of nematode parasites of man and animals dates back to 4,500 B.C. in the ancient Egyptian history and 2,700 B.C. in China. Hippocrates in 430 B.C. was the first to record the pinworm, Enterobius vermicularis. It will be worthwhile to mention here the names of some earlier workers who have contributed significantly to our knowledge of nematode parasites:

Celsus (53 B.C. - 7 A.D.), Galen (130 - 200 A.D.), Vegetius (400 A.D.), Abertus Magnus (1200 - 1280 A.D.) and Caesalpinus (1600 A.D.). Leidy, Virchow, Herbst and Lenkart also made important contributions in this field during 18th to 19th century.

Though the knowledge of animal nematodes is very ancient, the plant and soil nematodes were not discovered until the 17th century mainly because of their small size and the technical difficulties involved in their isolation from the soil and plant tissues. Borellus (1656) recorded the first free living nematode, while Needham (1743) was the first to discover the wheat gall nematode now known as Anguina tritici. Linnaeus (1767), Scopoli (1777), Steinbuch (1799) and others recorded the same species and noted it to be a serious pest of some other cereal also. Berkeley (1855) recorded the second plant parasitic nematode, Meloidogyne sp., while observing the galls produced on greenhouse grown cucumbers in England. Two years later, in 1857, Kuhn found yet another important nematode species which is now known as Ditylenchus dipsaci from the malformed floral heads of fuller's teasel.

The economic importance of plant parasitic nematodes was first realized when the production of commercially important sugar beet crop suddenly declined in Germany in the second half of the 19th century. In 1859, Schacht discovered a serious disease on sugarbeets caused by a species of cyst nematode which was named later Heterodera schachtii by Schmidt (1871). Due to

serious losses in the production of sugarbeets caused by H. schachtii, serious efforts were made by many subsequent workers (Kuhn, Liebscher, Wolz, Muller, Chatin and others) to study its life history, habits, distribution and methods of control. In the meantime, Muller (1786), Bory (1824), Dujardin (1845), Carter (1859), Eberth (1863) and a few others reported a large number of species of free living nematodes from the fresh and salt waters.

According to Thorne (1961), the monograph on Anguillulidae published by Bastian (1865) marked the beginning of nematology. In this monograph, Bastian described 100 new species of plant and soil nematodes but the descriptions and illustrations were rather poor. Bütchli (1873) for the first time provided detailed descriptions of free living nematode species and also gave a few parameters for differentiating the genera and species. De Man, a Dutch nematologist published in 1876 an excellent and authoritative monograph on plant, soil and fresh water nematodes. The de Manian formula for giving body dimensions of nematodes is still universally used in taxonomical studies on plant and soil nematodes. The excellent compilation by Örley (1881) of 202 species belonging to 27 genera of free living and plant nematodes became a valuable source of reference for nematologists in the coming years. All these significant contributions of the nineteenth century attracted many scientists to nematology during the early 20th century.

A real breakthrough in the history of nematology came when N.A. Cobb joined the U.S. Department of Agriculture in 1907. He (1890-1933) published a series of excellent papers on the taxonomy of fresh water, marine, soil, plant nematodes etc. Detailed morphological studies were carried out and new terminologies were coined by him. The illustrations prepared by Chambers for the scientific research papers of Cobb are still unmatched. An interesting phase of nematology started when Christie and others started to work on applied aspects of some important species of plant-parasitic nematodes in 1936. The history of nematology will remain incomplete without mentioning the valuable contributions made by nematologists like Micoletzky, Hoffmanner, Fusch, Menzil, Stefanski, Steiner, Goffart, Schneider, Chitwood, T. Cooday, Shuurmans Stekhoven, De Coninck, Thorne etc. during the first half of the 20th century. The books by Chitwoods (1937, 50) and De Coninck (1965) on the morphology of nematodes revolutionised the taxonomy of nematodes. Thorne's monographs (1936-75) are landmarks in the history of nematology. Amongst those who pioneered the work in nematology during the last four decades are: Taylor, Golden, Allen, Tarjan, Krall, Raski, Oostenbrink, J. B. Cooday, Jones, Weyns, Andrássy, Coomans, Croll, Loof, Lamberti, Luc, Jairajpuri, Siddiqi, V. Ferris, Geraert and some others.

After the second world war, due to the awareness of the role played by plant nematodes in limiting agricultural productivity, the nematology has emerged as an independent discipline of biological and agricultural sciences. The nematodes are divided

under two main groups, viz., the nematode parasites of human beings and animals which are included in Helminthology, and the plant and soil nematodes which are dealt under Nematology. The marine and some fresh water nematodes are usually studied independently. Since the nematodes are highly diversified animals, the two main groups of nematodes, viz., animal nematodes and plant and soil nematodes, differ significantly and the taxonomists involved in research on these groups have different priorities and use different parameters in their identification procedures. As a result, the taxonomy of the nematodes has become quite a specialised job requiring our in-depth knowledge of these animals. The specialists of the two nematode groups rarely get an opportunity to exchange their views in national and international conferences and symposia. In fact, this situation has further aggravated the problems in bringing uniformity in the classification of nematodes.

A significant breakthrough in the development of nematology was achieved when the publication of the first international journal, Nematologica, began in 1956. At present seven international journals of high standard are published from different parts of the world which are exclusively devoted to papers on plant and soil nematodes. Some research papers are also published in peripheral journals. Every year a large number of papers are published on different aspects of nematodes like taxonomy, morphology, ecology, genetics, physiology, pathogenecity, crop losses, soil amendments, host-parasite relationships, control, etc.

Taxonomy papers get sufficient space in all these journals. A rapid growth in nematode taxonomy may be noted during recent years on the basis of available data. Only 9000 species were known till 1950 whereas the present figure is about 15,000 known species. The descriptions of about 300 new species are published every year. The use of Transmission and Scanning electron microscopes has brought a revolution in the nematode taxonomy. Inspite of all the modern facilities and concepts available, the morphological characters appear to be most practical and dominate the present day nematode taxonomy and would perhaps do so in the coming years. However, it does not mean that we should discard all other characters like genetics, embryology, ecology, ethology, physiology, serology, etc. Since the majority of nematode fauna is yet to be explored, the taxonomy must be based on simplicity and should provide quick informations.

In the recent years, taxonomical studies have become more important because the correct identification is the pre-requisite for all applied/experimental work. Sometimes all the money and energy could go waste due to wrong identifications of nematode species specially while controlling these pests by crop rotation. It has been noted that many closely related species of Heterodera, Meloidogyne, Pratylenchus, Hirschmanniella and other genera have different host preferences. Unless correct identification is made, it will be difficult to select proper crops. Achievements in finding out the resistant crop varieties also depend largely on the correct identity of the nematode pests.

The work on plant and soil nematodes in India started rather late, though a considerable work had been done on different aspects of animal nematodes. The first plant parasitic nematode (root-knot) was reported by Barber (1901) from tea gardens of South India. Butler (1906) encountered another species of root-knot nematode on black pepper in Kerala. In 1913, he also reported ufra disease of rice caused by Ditylenchus angustus in Bengal. Cobb (1913) reported a species of Criconema (= now Hemicriconemoides) from around roots of mango tree in Bangalore (Karnataka). Only a few more stray references are available prior to 1939 (Krishnan, 1933; Ayyar, 1934; Dastur, 1936; Luthra and Vasudeva, 1939; Thapar, 1941; Thomas, 1948; Sanwal, 1951, 1954; Singh, 1952). Cooley (1951) described two new species, Ditylenchus drepanocercus and Aphelenchoides sphaerocephalum from India.

The Department of Zoology of Aligarh Muslim University became the first centre in India to initiate research on the taxonomy of plant and soil nematodes. It was under the able and dynamic leadership of (late) Prof. M. A. Basir that M. R. Siddiqi began his research on nematodes in 1955. Professor Basir had already made valuable contributions on animal nematodes including an authoritative monograph on insect nematodes. Siddiqi published his first paper on nematodes in 1959. In the meantime, Das (1960) from Osmania University published a valuable paper on the nematodes of Andhra Pradesh. Z. Khan and S. H. Khan also joined the team of Professor Basir in 1960. In 1961, M. Shamim

Jairajpuri was enrolled as a Ph.D. student under guidance of Dr. Ather H. Siddiqi, a parasitologist of international repute and the present Chairman of the Zoology Department of the Aligarh Muslim University. In 1961, F. G. W. Jones of Rothmasted Experimental Station, U.K., visited Aligarh and imparted advanced training in nematology to the young and highly dedicated workers viz., Siddiqi, Jairajpuri, S. H. Khan, S. Khan, etc. These young and dedicated nematologists published about 100 papers on the taxonomy of nematodes and described more than 150 new species from India up to 1965. Most of these papers were published in journals of international repute. Drs. M. R. Siddiqi and S. Khan left the Zoology Department in 1964, the former joined the Botany Department at A.M.U., Aligarh and the latter IARI, New Delhi. Dr. Siddiqi later (1967) proceeded to U.K. as an employee of the Commonwealth Institute of Helminthology (now International Institute of Parasitology).

The Nematology in India developed with rapid pace after 1965. The Aligarh centre played a key role in taxonomical research in the country. Jairajpuri was the first one in India to initiate work on nematode behaviour and biological control. His book on Predatory nematodes and other publications on Tylenchida, Dorylaimida and Mononchida have become a landmark in the history of nematology of India. It is interesting to note that out of about 700 research papers published on nematode taxonomy from India to date, over 300 (including 3 monographs and a book) have been published from the Zoology Department of

Aligarh Muslim University. Of the remaining papers, about 50% have been published by taxonomists trained in this department: Z. Khan at I.A.R.I., New Delhi; Baqri at Zoological Survey of India, Calcutta; Sultan at Punjab Agricultural University, Ludhiana; Bajaj at Haryana Agricultural University, Hissar; and Rahman at Assam Agricultural University, Jorhat. The post-graduate nematology courses were introduced for the first time in the Zoology Department in 1968.

Realizing the importance of nematodes and encouraged by the achievements made by the Zoology Department, Dr. Abrar M. Khan, a plant pathologist in the Department of Botany of the Aligarh Muslim University, organised research in nematology on basic as well as applied aspects. S. I. Husain (1962) started work on the taxonomy of nematodes and published some papers in the sixties. Meanwhile, Siward and Misra from Naini Agricultural Institute, Allahabad also contributed to the taxonomy of criconematids of India.

In 1962, the basic work on nematodes was initiated at Indian Agricultural Research Institute by Prasad, Gopal Swarup and Chawla. At the same time, A. R. Seshadri and his co-workers undertook a research project on the potato cyst nematode in the Nilgiri Hills, Ootacamund, Tamil Nadu. The Government of India and Indian Council of Agricultural Research realised the economic importance of phytophagous nematodes and created an independent Division of Nematology at I.A.R.I., New Delhi in 1966. Dr. A. R. Seshadri was appointed as the first Head of the Division in 1967.

During the last 25 years a remarkable progress has been made in nematological research in India. Many young workers have received training by attending the South East Asia Post-graduate Nematology Courses (1967-79) organised jointly by the Aligarh Muslim University; I. A. R. I., New Delhi and the Agricultural University, Wageningen, The Netherlands. The Nematological Society of India was founded in 1969 and its official publication, Indian Journal of Nematology, was first published in 1971. This was a great achievement as this became the third international journal in the field of nematology. At present over 200 nematologists are involved in research at more than 30 centres, mainly located at Aligarh (Zoology), Aligarh (Botany), IARI, New Delhi; Hissar; Ludhiana; Udaipur; Kanpur; Jhansi; Bangalore; NBPGR, New Delhi; Pantnagar; Trivandrum; Bhubaneswar; Santiniketan; Pusa; Coimbatore and ZSI, Calcutta. Post-graduate teaching has also been initiated at almost all the agricultural universities.

The progress of research in nematology has been quite impressive in the field of taxonomy, ecology, behaviour, biology, pathogenecity, estimation of crop losses, disease complexes, physiology, control including soil amendments, etc. It would be worthwhile to mention here names of some of those who have brought the Indian Nematology to the fore-front in the international field: Jairajpuri, Seshadri, Dasgupta, B. Khan, Swarup, Bhatti, Yadav, Khera, S. N. Das, Mathur and a few others.

A large number of research papers are published every year from India in the Indian Journal of Nematology on different aspects of nematodes including taxonomy. Some of the taxonomical papers from India are also published in international journals like Nematologica, Revue de Nematologie and Nematologia Mediterranea etc. Despite this the basic research in nematology in India still suffers mainly due to lack of literature and some other facilities like the non-availability of good microscopes in many laboratories. This has obviously created some confusion in the early stages but the future of nematode taxonomy appears quite bright in India.

In January 1966, the present author initiated research work in nematology as a first Ph.D. student of Professor M. S. Jairajpuri in the Department of Zoology of the Aligarh Muslim University. The following fibrous crops of economic importance were selected for the study of nematodes: three species of cotton, viz., Gossypium hirsutum L., G. herbaceum L. and G. arboreum L., the sun hemp, Crotalaria juncea L., and patson, Hibiscus cannabinus L. During the course of investigations, about 90 species belonging to the Orders Tylenchida, Dorylaimida and Mononchida were reported, 20 of which were described as new to the science. In addition, two new genera, Millinema Baqri & Jairajpuri, 1967 and Morasia Baqri & Jairajpuri, 1968 were also proposed. The males of three known species were reported for the first time. The intraspecific variations were also studied in two commonly found species viz., Tylenchorhynchus mashhoodi

Siddiqi & Basir, 1969 and Thornenema mauritianum (Williams, 1960) Baqri & Jairajpuri, 1967. The emphasis was mainly on nematodes belonging to the Order Dorylaimida because some of the species of dorylaims having long odontostyles either directly damage the plant roots or act as virus vectors. Moreover, the dorylaims are also important because majority of the species are suspected to be predaceous in their feeding behaviour.

In November 1969, I was awarded a fellowship by the Rijksuniversiteit, Gent, Belgium to participate in the first international post-graduate nematology course under the leadership of Professor L. A. P. De Coninck, the foremost nematologist in general nematode morphology and taxonomy of marine nematodes. During stay in Belgium, Professor A. Coomans, a person of dynamic leadership and a nematologist of great eminence suggested to me that I should revise the descriptions of dorylaim species reported by Schuurmans Stekhoven & Teunissen (1938) and Schuurmans Stekhoven (1944) from the Republic of Zaire. The material used in these two publications was brought to Belgium by Professor De Coninck. The revision was felt necessary because some of the new species had been described on single specimens or on juvenile(s). A few species had been described which were actually complex of several species as was evident from the illustrations. The revisionary work by the present author, under the supervision and collaboration of Professor Coomans, resulted in three important publications on nematodes of the families Dorylaimidae, Aporcelaimidae, Longidoridae,

Actinolaimidae and Belondiridae. Another paper on the species of Belondira from Africa was also published in collaboration with Coomans.

In August 1971, I returned to India and joined the Department of Zoology at Aligarh Muslim University, as a Pool Officer of the CSIR, New Delhi. This gave me yet another opportunity to do research work in collaboration with my teacher, Professor Jairajpuri. We worked mainly on the nematodes of the high altitudes in India and published four papers during 1971-73. But in 1973, I was selected for the post of Zoologist in the Zoological Survey of India at Calcutta and had to leave Aligarh to join the new assignment. A challanging task and tremendous opportunity awaited me in Calcutta.

The Zoological Survey of India is a unique institution where scientists work on different animal groups and are mainly involved in the exploration and identification of the faunal wealth of the country. My first task was to initiate work on nematodes of fruit trees in West Bengal and this resulted in the publication of a series of papers entitled, "Nematodes from West Bengal (India)". In 1977, the Zoological Survey of India became one of the 14 centres of the All India Coordinated Research Project on Nematode Pests of Crops and their Control (sponsored by the DBT and ICAR, New Delhi). As principal investigator of the project, I conducted many intensive and random surveys for the nematodes associated with paddy and citrus trees in the districts of West Bengal and the State of Sikkim. Besides

taxonomical studies, the object of these surveys was to identify the key and the potential pests of paddy and citrus in these two eastern states of India. From the qualitative and quantitative studies on different groups of nematodes it was concluded that Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963; Meloidogyne graminicola Golden & Birchfield, 1965 Helicotylenchus spp. and Tylenchorhynchus spp. are important pests of paddy in West Bengal. Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958 appeared to be the key pest of citrus in Sikkim.

In the present study, an attempt has also been made to provide a guideline to the new taxonomists working on dorylaims so that the quality of the descriptions and illustration of nematodes in their research papers may be improved. In this regard, a paper was prepared discussing all the morphological characters of taxonomical importance in the suborder Dorylaimina. Encouraged and convinced by the findings made by Loof and Coomans (1968) on the taxonomical importance of the positions of oesophageal gland nuclei and their orifices in different groups of dorylaims, the author also prepared a paper on the locations of oesophageal gland nuclei and their orifices in different families of the Order Mononchida.

The present thesis incorporates all the research papers reporting the results obtained by the author since 1966.

Under the Order Tylenchida 69 species have been reported belonging to the families Tylenchidae (10), Tylenchorhynchidae (12), Hoplolaimidae (20), Meloidogynidae (1) Pratylenchidae (6), Criconematidae (7), Hemicycliophoridae (2), Psilenchidae (2), Rotylenchulidae (1), Paratylenchidae (2) and Anguinidae (6), A new genus Indoditylenchus under the family Anguinidae has also been proposed. In fact, many of these species were described under different families, but at present the classification of the Order Tylenchida as proposed by Siddiqi (1986) has been followed except that of the family Tylenchorhynchidae which has been considered as valid. Twelve new species of the Order Tylenchida were found and these have been described in dtail. It was also felt necessary by the present author to study the variations and to provide statistical analysis of different morphological characters in important and widely distributed species so that these may be identified correctly before any applied work is initiated. Moreover, the study on variability brings about stability to the taxonomy of a group and the related taxa. In view of these facts, the allometric and morphometric variations of the following commonly found parasite species have been studied; Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959; Tylenchorhynchus nudus Allen, 1955; Tylenchorhynchus goffarti Sturhan, 1966; Helicotylenchus crenacauda Sher, 1966; Helicotylenchus dihystera (Cobb, 1893) Sher, 1961; Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963; Hirschmanniella oryzae (v. Breda de Haan, 1902) Luc & Goodey, 1963; and Scutellonema brachyurum (Steiner, 1938) Andrássy, 1959. Keys to species of

the genera Tylenchorhynchus Cobb, 1913 and Hoplolaimus Daday, 1905 have been prepared.

The species of the Order Dorylaimida have been reported in large numbers. Out of about 300 species under 16 families, 76 have been described as new to science. A new subfamily and three new genera under the family Thornenematidae have been proposed. Another new genus under the family Dorylaimoididae has been described. A large number of known species have been redescribed. Several synonymies and new combinations have been proposed during the course of these investigations. The status and identification of many known taxa have been revised. The males of five known species have been described for the first time. Wherever necessary, keys for identification of genera and their species have been provided. A paper also discusses the characters to be considered important in the taxonomy of Dorylaimina.

During the last 20 years, many changes have been proposed in the classification of Dorylaimida. The inflation in the number of higher taxa has been noted with great concern by the author in recent years. The names of families and superfamilies have been avoided in the introduction of this thesis because the proposals of higher categories and the splitting of genera has created more problems rather than solving them. Though many higher categories have been accepted in the present study, these are still unsatisfactory. Since I am involved in the taxonomy of

dorylaims for the last two decades, I intend proposing certain changes in the classification based on sound reasoning, but this will be first discussed in symposia before publication.

The thesis also includes the description of four new species and report of 18 known species belonging to 11 genera and 6 families of the Order Mononchida. One paper exclusively deals with the locations of oesophageal gland nuclei and their orifices. The male of Anatonchus cinglymodontus Mulvey, 1961 has been described for the first time. In addition, the soil nematodes belonging to some other Orders have also been studied. The diagnosis of the genus Tridontus Khera 1965 (Diplogasteridae) has been amended and the genus Syediella Suryawanshi, 1971 has been synonymised with the former. Two new species from mangrove environment of the deltaic Sunderbans, West Bengal, India have also been described under the families Anoplostomatidae and Oxystomin idae (one each). Sometimes, the soil samples or the nematodes were received through the courtesy of friends and well wishers from other parts of India and also from some foreign countries. These nematodes were studied and the results have been included in the present thesis. It may be pointed that the status of some of the taxa described as new by the author has changed recently due to splitting, synonymy etc., but for the sake or originality of the work these have been reported as such.

While revising the family Thornenematidae, the type species of the genus Indodorylaimus Ali & Prabha, 1974 was found to be

misidentified. As per code of Zoological Nomenclature, I sent an application to the Commission and proposed a new name for the specimens of Ali & Prabha. To this Siddiqi raised an objection which was suitably replied. The correspondance was published in Bull. zool. Nom., 1984, and was subsequently referred to the members of the Commission. The opinion of the members supported my contention. Since this is an interesting nomenclatorial problem, the correspondance and the opinion of the members which was published in the Bull. zool. Nom. is being incorporated in the thesis.

It may be concluded from the introductory write up that the taxonomy of plant and soil nematodes is passing through the alpha or early (descriptive) phase. Though it has progressed with rapid pace during the past 25 years, our knowledge of nematode fauna remains still very poor as only 3-4% of the estimated faunal wealth is known to us. The author feels that the taxonomy is a highly specialised job, particularly that of nematodes because their diagnostic characters are very minute. However, the nematode taxonomists are lucky to have modern sophisticated equipments, like Scanning and Transmission electron miscroscopes, many experimental and applied techniques, use of computers etc. which were not available to the taxonomists working on other groups (e.g., insects, helminths) of animals in the early stage of taxonomy. Unfortunately, these facilities are not available in all laboratories of the world, particularly those of the developing countries.

Under these circumstances, good training is required for the taxonomists not only to study morphological and other characters but also to prepare accurate drawings of the taxa. Faulty observations may confuse future workers as was noticed by the present author while revising the species described by Shuurmans Stekhoven & Teunissen (1938), Shuurmans Stekhoven (1944) and Khera (1970). The accuracy of the drawings is also very important as has been pointed out by the present author in a paper on the characters to be considered in the taxonomy of Dorylaimina.

The inflation in the number of higher categories should be avoided as far as possible because our knowledge of nematode fauna is very meagre. The splitting of groups has further aggravated the problems and in many instances has obliterated natural inter-relationships of the taxa. In some cases it was noticed that it is far easier to identify certain genera rather than the families to which they belong. Hence, the rapid development in nematode taxonomy, particularly that of higher taxa, has created more problems for the taxonomists themselves. In fact, many gaps in the evolutionary process of nematodes are yet to be traced and filled up. Sometimes, new schemes of classifications together with the proposal of higher categories without proper knowledge of inter-relationship of the group become quite confusing. In groups like birds, mammals etc., where most of the species have been identified, it is easy to work out inter-relationships and present a satisfactory scheme of classification. But in nematodes it is difficult to give a sound classification at least for the

timebeing as the higher taxa are likely to be based on wrong assumptions.

In view of these facts, it is hereby proposed that we should have specialists on different groups of nematodes so that they may sort out the problems confronting that group more easily and authoritatively. Some people may disagree with this proposal because for them specialisation is only to know more and more about less and less. The author feels that it is the most appropriate time in the history of nematode taxonomy to know more and more about each group of nematodes. For the present, it is expected of the taxonomists to give descriptions of species as complete as possible in all respects adequately supported by well drawn illustrations. The genera should be proposed on the basis of well-defined groups of species and should be demarcated from one another as clearly as possible. The proposal of familial and Ordinal ranks should be restricted to minimum as these are likely to create confusion because of our limited knowledge of nematode taxa.

Since all the surveys conducted by the present author in West Bengal revealed that Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963 is a key pest of paddy crop, three field experiments were conducted during the course of the study, viz., seasonal variations in the population levels of H. gracilis, estimation of crop losses due to H. gracilis in paddy crop, and the effects of different sources of nitrogen on the management

of H. gracilis. Three papers based on the results obtained from the above mentioned experiments are added as supplement to the present thesis.

The contents of the thesis form the basis of 67 research papers. This also includes two abstracts of full papers published in the proceedings of symposia. However, these have not been incorporated because they have been included as part of other papers.

Nematologica 12 (1966): 396-402. E. J. Brill, Leiden

SECTONEMA PROCTA N. SP., AND *PUNGENTUS ANGULATUS* N. SP., TWO NEW SOIL-INHABITING NEMATODES

BY

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Sectonema procta n. sp., is 4.9-5.5 mm long; has very thick cuticle; about 200 lateral body pores arranged in a single row or irregularly; about 100 ventral body pores distributed between base of mural tooth and anus; about 15 dorsal body pores distributed between base of mural tooth and middle of esophagus; small egg one-third of body width long; rectum one and a half anal-body-widths long and males unknown. *Pungentus angulatus* n. sp., is 0.8-1.0 mm long; has spear about two head widths long; slender body (a = 46-52); short convex-conoid to bluntly rounded tail (c = 64-72); opisthodelphic reproductive organs; anterior uterine branch minute and males unknown.

Two new dorylaimoid nematodes belonging to the genera *Sectonema* Thorne, 1930 and *Pungentus* Thorne & Swanger, 1936 are described below. This appears to be the first record of new species of these two genera from India.

The specimens used in this study were killed and fixed in hot 4% formalin and then transferred to a mixture of 5 parts glycerine and 95 parts 30% alcohol. While in this mixture they were kept in a desiccator and were allowed to dehydrate at room temperature for about three weeks and then finally mounted in pure dehydrated glycerine. All measurements and observations were made on specimens mounted in glycerine.

SECTONEMA PROCTA N. SP.

(Fig. 1, A-E)

Dimensions: ♀♀ (3): L = 4.9-5.5 mm; a = 56-57; b = 5.0-5.4; c = 116-134; V = $^{10\text{-}11}53\text{-}57^{9\text{-}10}$.

Holotype (♀): L = 5.5 mm; a = 57; b = 5.4; c = 123; V = $^{10}53^{9}$.

Body long cylindroid, curved in posterior third of its length, tapering gradually anterior to base of esophagus to a well offset lip region. Cuticle very thick, smooth, 7 μ in the esophageal region, 7-11 μ near middle of body and 12-16 μ on or just in front of the tail. Lateral chords very distinct, occupying one-seventh to one-eighth of body-width near vulva. Lateral body pores about 200, arranged in a single row anterior to vulva and then irregularly. Ventral body pores about 100, distributed at irregular intervals between base of mural tooth and anus. Dorsal body pores about fifteen distributed irregularly between base of mural tooth and middle of esophagus. Lip region distinctly set off from the body, more than

one-third of body-width at base of esophagus. Amphids cup-like, their apertures about half as wide as the head; sensilla pouches just below the base of mural tooth, 16-20 μ from the level of amphidial slits. Spear a mural tooth, 13-15 μ

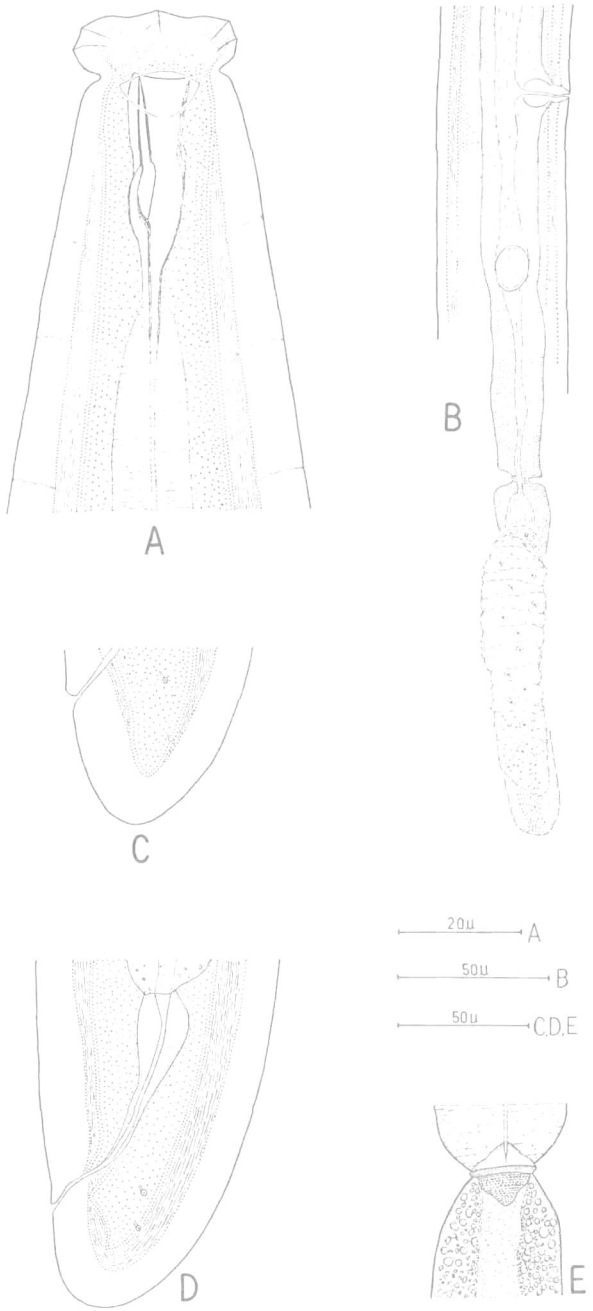

Fig. 1, A-E. *Sectonema procta* n. sp. A — Head end. B — Posterior sexual branch. C — Tail. D — Tail and rectum. E —Cardia region.

long, half as long as the head-width. Pharyngeal cavity 37-40 μ long, narrowing in posterior third to join the esophageal lumen. Esophagus consists of an anterior slender part, gradually expanding to form the basal expanded portion which occupies about two-thirds of the total esophageal length (in one paratype it is only slightly more than half the total length). Width of basal expanded portion more than half that of body at base of esophagus and one-twelfth to one-fifteenth of its total length. Only the dorsal esophageal gland nucleus distinctly visible, situated 30 μ behind the gland opening which is at the junction of anterior slender part and expanded portion of esophagus. Cardia conoid. Nerve ring 210-220 μ from anterior end. Intestine thick-walled, lumen broad and containing remains of enchytraeids in places. Vulva transverse; vagina about half to one-third of body-width long. Uteri and oviduct nearly equal in length, each slightly less than thrice the body-width at vulva, and separated by a distinct sphincter. Ovaries amphidelphic and reflexed about one-third way back to vulva. Oöcytes arranged in a single row. Egg very small, measuring 38 $\times$ 26 μ, about one-third of the corresponding body-width. Prerectum 190-240 μ long, about thrice the anal-body-width. Rectum 80-100 μ long, about one and a half anal-body-widths. Tail hemispheroid, 38-45 μ long, less than one anal-body-width. A pair of caudal pores visible with difficulty.

Male: Not found; sperm not present in the uteri.

Holotype: Collected on October 8, 1964; slide number SECT/001; deposited in the Zoology Museum of Aligarh Muslim University.

Paratypes: Two females; other data as above, slide number SECT/002.

Type locality: Soil around roots of citrus and cotton plants from Said Nagli, Moradabad (U.P.), India.

Differential diagnosis: *Sectonema procta* n. sp., is close to *S. ventralis* Thorne, 1930 and *S. sica* Clark, 1964. From the former it differs in having shorter body, cuticle very thick on tail, lateral body pores in a single row or irregularly arranged, ventral body pores about 100, dorsal body pores about fifteen (only a few ventral and dorsal pores present in *S. ventralis*), egg only one-third of body-width, longer rectum and slightly longer tail. From *S. sica* it differs in having a slender body (a = 29 in *S. sica*), ventral pores about 100, dorsal pores about 15 (only four ventral and dorsal pores present in *S. sica*), different shapes of lip region and mural tooth, shorter esophagus (b = 4.1), smaller egg (egg twice the body-width in *S. sica*), posterior position of vulva (V = 40 in *S. sica*), longer rectum (only one anal-body-width long in *S. sica*) and shorter and differently shaped tail.

PUNGENTUS ANGULATUS N. SP.

(Fig. 2, A-D)

Dimensions: ♀♀ (21): L = 0.8-1.0 mm (0.9 mm); a = 46-52 (49); b = 3.9-4.4 (4.1); c = 64-72 (67); V = $46\text{-}53^{9\text{-}14}(50^{12})$.

Holotype (♀): L = 0.9 mm; a = 46; b = 4; c = 66; V = 48^{12}.

Body cylindroid, curved in posterior third of its length, tapering gradually in front of the slender part of the esophagus to a well offset lip region. Cuticle smooth, 1-2 μ thick. Lip region wider than adjoining body and less than half as wide as body at base of esophagus. Lips very distinctly angular; cephalic papillae easily visible. Four cuticularized platelets surround the stoma entrance. Lateral chords about one-seventh to one-eighth of body-width near vulva. Amphids cup-

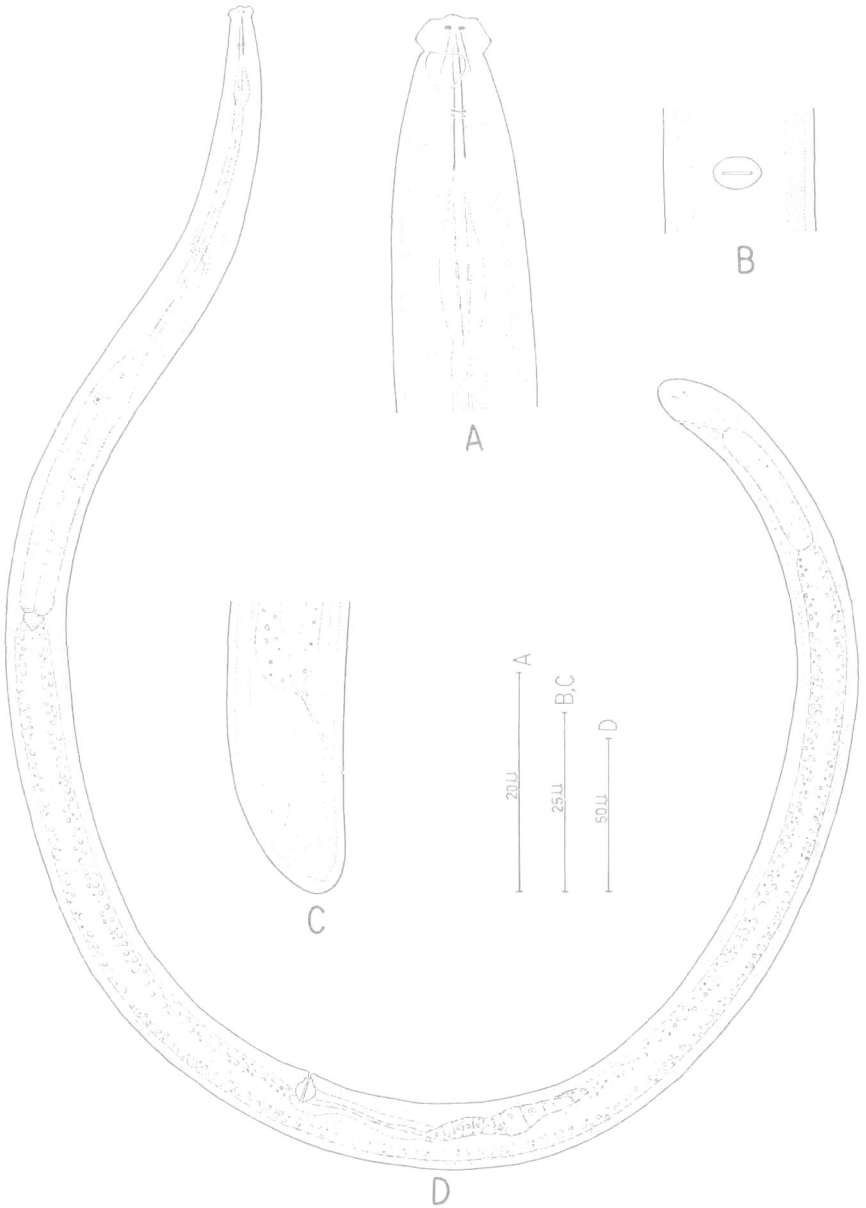

Fig. 2, A-D. *Pungentus angulatus* n. sp. A — Head end. B — Vulva. C — Tail region. D — Entire female.

like, their apertures about half the head-width; sensilla pouches not seen. Spear 14-16 μ long, slightly less than twice the head-width, and bent dorsally; the aperture occupying one-fifth to one-sixth of spear length. Spear guiding ring double, near middle of spear, the anterior one more bright. Spear extension simple, about as long as spear. Esophagus consists of an anterior slender part gradually expanding to form the basal expanded portion which is less than half the total length of esophagus. Width of the basal expanded portion about half of body-width at base of esophagus, and one-seventh to one-eighth of its total length. Only the dorsal esophageal gland nucleus and its opening visible (as illustrated). Nerve ring about 80-85 μ from anterior end. Cardia somewhat conoid. Vulva transverse, slit-like about one-fifth of body width; vagina slightly less than half the body-width long. Anterior gonad absent, only a minute trace of anterior uterus present. Uterus and oviduct of the posterior sexual branch not distinctly separated, their combined length about four times the body-width. Ovary opisthodelphic and reflexed one-third to half-way back to vulva. Oöcytes arranged in a single row. Prerectum 43-50 μ long, less than four times the anal body width. Rectum 16-18 μ long, about one anal-body-width. Tail convex-conoid to bluntly rounded, about one anal-body-width long. A pair of obscure caudal pores present.

Males: Not found; sperms not present in uterus.

Holotype: Collected on October 25, 1963; slide number PUNG/001; deposited in the Zoology Museum of Aligarh Muslim University.

Paratypes: Twenty females; other data as above, slide numbers PUNG/001-005.

Type locality: Soil around roots of apple, *Pyrus malus* L. from Srinagar, Kashmir, India.

Additional locality: Two females from soil around roots of cotton plants from Aligarh (U.P.), India.

Differential diagnosis: *Pungentus angulatus* n. sp. comes closest to *P. engadinensis* (Altherr, 1950) Altherr, 1952 but differs in having angular lips (lips rounded in *P. engadinensis*); amphidial slits only half the head-width (amphidial slits three-fourths of head-width in *P. engadinensis* as illustrated by Andrássy, 1962); slender body (a = 38-39 in *P. engadinensis*) and a short tail (c = 43 in *P. engadinensis*).

KEY TO THE SPECIES OF PUNGENTUS

1. Spear slender, about two head-widths long, slightly arcuate 2
   Spear about one head-width long, straight 11
2. Length 3.5 mm or over . . . . . *textilis* (Thorne & Swanger, 1936) Thorne, 1939
   Length 2.0 mm or less 3
3. Ovaries two 4
   Ovary single 6
4. Lips angular, very prominent; length 2.0 mm . . . . . *angulosus* Thorne, 1939
   Lips not angular, low or rounded; length 1.7 mm or less 5
5. Amphids about two-thirds as wide as head, narrowing rapidly with a slight constriction in the middle . . . . . *pungens* Thorne & Swanger, 1939
   Amphids wine-glass shaped, only half the head-width . . . . . *marietani* Altherr, 1950
6. Anterior rudimentary uterine branch one or more than one body-width long; males known . . 7

Anterior rudimentary uterine branch less than half body-width long; males unknown . 8
7. Anterior rudimentary uterine branch only one body-width long; tail hemispheroid . . . . . *monohystera* Thorne & Swanger, 1936
Anterior rudimentary uterine branch three body-widths long; tail usually conoid . . . . . *sparsus* Thorne, 1939
8. Length 1.0 mm or less 9
Length 1.5 mm or more 10
9. Lips rounded; a = 38-39; c = 43 . . . . *engadinensis* (Altherr, 1950) Altherr, 1952
Lips angular; a = 46-52; c = 64-72 . . . . . *angulatus* n. sp.
10. Lips very angular; amphid apertures three-fourths of head-width . . . . . *silvestris* (de Man, 1912) Coomans & Geraert, 1962
Lips somewhat rounded; amphid apertures less than half head-width . *maorium* Clark, 1963
11. Ovaries two 12
Ovary single 13
12. Length 2.2 mm . . . . . *brevidentatus* Thorne, 1939
Length 0.6-0.7 mm . . . . . *pumilus* Andrássy, 1963
13. Anterior uterine branch absent . . . . . *parvus* Thorne, 1939
Anterior uterine branch present 14
14. Length 0.9 mm; lips low, amalgamated . . . . . *microdentatus* Thorne, 1939
Length 1.4 mm; lips prominent, angular . . . . . *obscurus* Thorne, 1939

Not included in the Key: The following species have been considered *species inquirendae* because of poor and inadequate descriptions.

Pungentus ichthyuris (Cobb, 1906) Thorne & Swanger, 1936
P. intertextus (Thorne & Swanger, 1936) Thorne, 1939
P. minnsi (van der Linde, 1938) Andrássy, 1960
P. stylidens (Schuurmans Stekhoven, 1951) Andrássy, 1960
P. fuorni (Altherr, 1950) Goodey, 1963.

ZUSAMMENFASSUNG

Sectonema procta *n. sp. und* Pungentus angulatus *n. sp., zwei neue bodenbewohnende Nematoden*

Zwei neue Arten der Dorylaimoidea, zu den Gattungen *Sectonema* Thorne, 1930 und *Pungentus* Thorne & Swanger, 1936 gehörig, wurden aus Indien beschrieben. *Sectonema procta* n. sp. ist 4,9-5,5 mm lang und besitzt eine sehr dicke Cuticula. Die rund 200 Lateralporen sind in einer einzigen Reihe oder unregelmäßig angeordnet. Zwischen der Basis des Mundstachels und dem Anus liegen etwa 100 ventrale und zwischen Stachelbasis und Oesophagusmitte etwa 15 dorsale Körperporen. Die Länge der Eier beträgt nur 1/3 der Körperbreite, die des Enddarms eineinhalbe Körperbreite. Männchen sind nicht bekannt.

Pungentus angulatus n. sp. ist 0,8-1,0 mm lang und besitzt einen Mundstachel, dessen Länge der doppelten Kopfbreite entspricht. Der Körper ist schlank (a = 46-52) mit einem konvex-konoiden bis stumpf abgerundetem Schwanz (c = 64-72). Die Geschlechtsorgane sind opisthodelphisch, wobei der vordere Uterusast sehr klein ist. Männchen sind unbekannt. Es wird ein Schlüssel für die *Pungentus*-Arten mitgeteilt.

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REVIEW OF THE GENUS *THORNENEMA* ANDRÁSSY, 1959 AND PROPOSAL OF *WILLINEMA* N. GEN.

BY

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Thornenema baldum is redescribed together with the description of its male here recorded for the first time and *T. paradoxum* is made its synonym. *Chrysonema mauritiana* is transferred to *Thornenema*. *Thornenema viriosum*, *T. filiforme*, *T. africanum* and *T. delhiensis* are considered as synonyms of *T. mauritianum*. Emended diagnosis, relationship and key to the valid species of *Thornenema* are given. *Willinema* n. gen. is proposed for *Thornenema parvum* differentiated from *Thornenema* in shape of its tail. *Willinema indicum* n. sp. from Tuticorin, India is described.

Andrássy (1959) proposed the genus *Thornenema* for the following species of *Dorylaimus* Dujardin, 1845 which possess narrow, amalgamated lip region, mono-opisthodelphic gonad and long filiform tail: *D. lissus* Thorne, 1939; *D. limnophilus* de Man, 1880; *D. laevicapitatus* Cobb in Thorne & Swanger, 1936; *D. thienemanni* W. Schneider, 1937; *D. baldus* Thorne, 1939 and *D. cavalcantii* Lordello, 1955. In 1960 he also included *Dorylaimus sylphoides* Williams, 1959 in this genus. Williams (1964) described a new species, *T. viriosum*, redescribed *T. baldum* and *T. sylphoides* and also transferred *Labronema parvum* Williams, 1959 into *Thornenema* because of its narrow, amalgamated lip region and mono-opisthodelphic gonad. Loof (1964) redescribed *T. cavalcantii* from Venezuela and transferred *T. limnophilum* to the genus *Dorylaimoides* Thorne & Swanger, 1936. Loof (l.c.) also described *Thornenema* spec. 1 & 2 which cannot be regarded as species of *Thornenema* because of their lip region and tail shapes. Siddiqi (1965) added two new species: *T. filiforme* and *T. paradoxum* and also reported *T. cavalcantii* from India. Prasad & Chawla (1965) described *T. delhiense* (*delhiensis* emended) from New Delhi, India. Andrássy (1965) described *T. africanum* from Ghana and also transferred *T. limnophilum* to *Dorylaimoides* and *T. parvum* to *Eudorylaimus* Andrássy, 1959. Jairajpuri (1966) amplified the description of *T. thienemanni* from specimens collected in India. This species was earlier considered as *species inquirenda* by Siddiqi (1965) because inadequate information was available on its morphology.

A large number of specimens of *Thornenema* has been collected in recent years. They represent the species: *T. baldum* and *T. mauritianum* (Williams, 1959) n. comb. (= *Chrysonema mauritiana* Williams, 1959). *Thornenema baldum* was found near Tuticorin, Kurnool and Bombay in India. The Tuticorin population also includes two males which are reported here for the first time in this genus. *Thornenema mauritianum* has been collected from Aligarh, Mathura, Kur-

nool, Aurangabad and Andamans in India. A population representing the same species was also collected from soil samples brought from Malaysia.

Andrássy (1965) did not agree with Williams (1964) and considered *Labronema parvum* under the genus *Eudorylaimus*. However, in our opinion this species certainly does not belong in *Eudorylaimus* because of its narrow, amalgamated lip region, mono-opisthodelphic gonad and rounded tail. The inclusion of *Labronema parvum* in *Thornenema* also is not justified because of the tail shape. A study of the paratypes of *Labronema parvum* obtained from Rothamsted Experimental Station, and of a similar species collected in India indicate that they constitute a distinct group *Willinema* n. gen. The name proposed is in honour of Dr. J. R. Williams.

All the specimens used in this review were fixed in formalin. Observations and measurements were taken on specimens mounted in glycerine.

THORNENEMA BALDUM (THORNE, 1939) ANDRÁSSY, 1959
(Figs. 1 & 2)

syn. *Thornenema paradoxum* Siddiqi, 1965

Dimensions: See Table I.

TABLE I
Dimensions of Thornenema baldum

Population	No.	L (in mm)	a	b	c	V/T
1. Tuticorin	10 ♀♀	1.01 (0.99-1.04)	30 (29-31)	5.1 (4.7-5.6)	9 (7-10)	34^{11} ($30\text{-}37^{9\text{-}16}$)
	2 ♂♂	0.84-0.89	26-29	4.2-5.1	32-35	57-59
2. Kurnool	8 ♀♀	1.01 (0.93-1.07)	28 (24-30)	5.0 (4.7-5.7)	6 (6-7)	35^{11} ($33\text{-}36^{9\text{-}12}$)
3. Bombay	5 ♀♀	0.97 (0.93-1.00)	30 (28-32)	4.9 (4.8-5.0)	7 (6-8)	34^{11} ($32\text{-}35^{10\text{-}12}$)
4. Thorne, 1939	1 ♀	1.00	31	4.7	6	33^{12}
5. Williams, 1964	5 ♀♀	1.00 (0.97-1.04)	30 (28-32)	5.1 (4.7-5.4)	7 (7-8)	34 32-36
6. Siddiqi, 1965 (of *T. paradoxum*)	1 ♀	1.32	36	5.3	9	35

Description:

Female: Body cylindroid, tapering gradually anterior to slender part of esophagus, slightly curved in posterior third of its length in Tuticorin population, curved posterior to its vulva in Kurnool population and curved in the posterior half of its length in Bombay population. Cuticle smooth, its thickness varies between 1-6 μ at various places in the body. Subcuticle with faint striations, less than 1 μ thick. Lip region narrow, truncated, amalgamated and strongly sclerotized. Its width about one-fourth of the body width at the base of esophagus and offset from the body by a depression. In Kurnool population the lip region is

not so truncated and marked off. Just below the lip region there are characteristic bulges in the tissues as pointed out by Williams (1964). Labial papillae visible. Lateral chords one-fifth to one-sixth body width near middle of body. Lateral body pores not seen. Amphids cup-shaped; their apertures about half of the corresponding body width, situated about 5-6 μ from anterior end. Sensillar pouches 17-19 μ from amphidial apertures (Fig. 1, E).

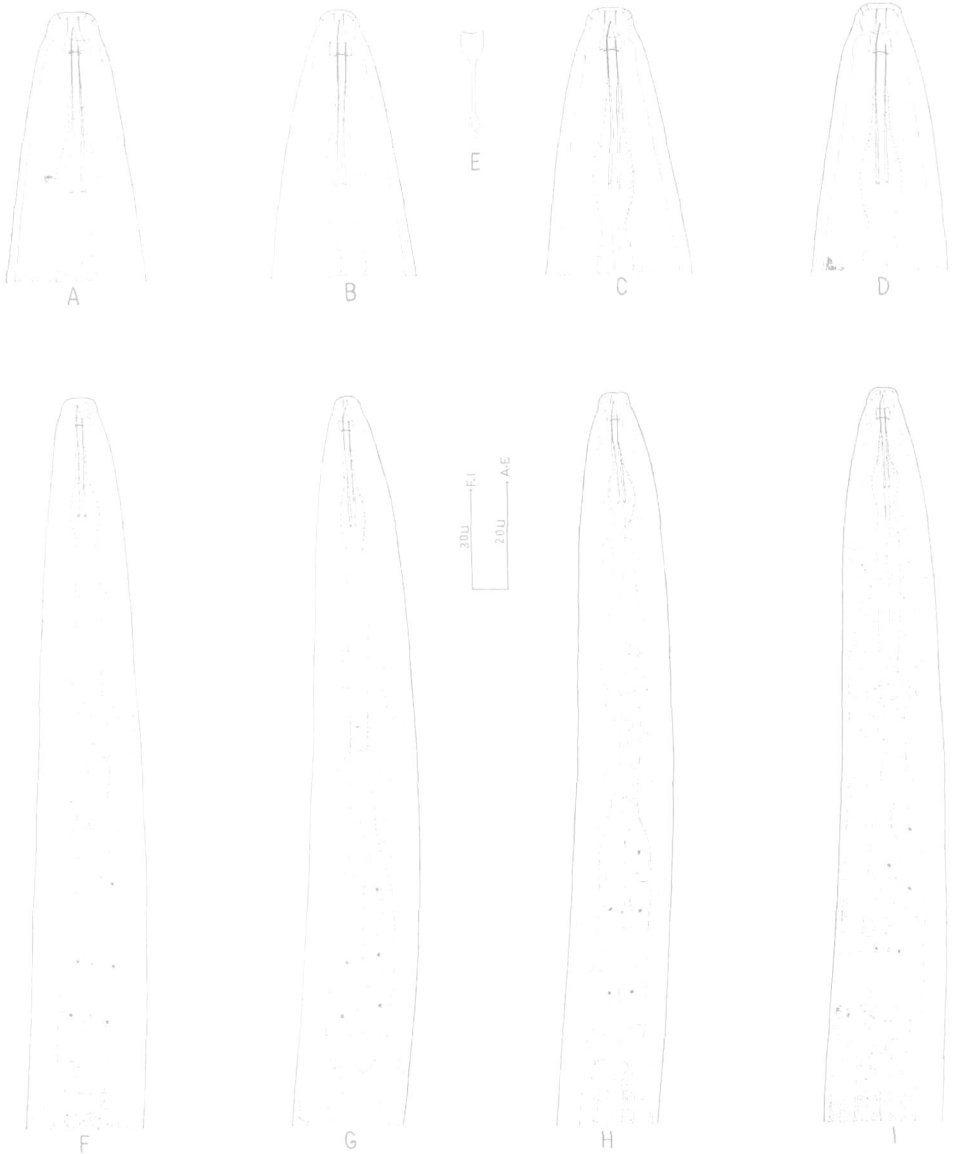

Fig. 1. *Thornenema baldum*: A & B: Head ends of Bombay and Kurnool populations respectively. C & D: Head ends of female and male, respectively, of Tuticorin population. E: Amphid of Kurnool population. F & G: Esophageal regions of Bombay and Kurnool populations respectively. H & I: Esophageal region of female and male, respectively, of Tuticorin population.

Spear cylindrical; 11-13 μ long (12-14 μ long according to Williams, 1964); aperture occupying about one-fourth or more of spear length. Spear extension 17-19 μ, simple, nearly one and a half times the length of the spear. Guiding ring single but may appear double in some specimens, the fixed ring 7-8 μ from the anterior end of the body. Esophagus consists of an anterior slender

Fig. 2. *Thornenema baldum*: A, B & C: Female gonads of Bombay, Kurnool and Tuticorin populations, respectively, D: Male tail, E & F: Female tails of Bombay and Kurnool populations, respectively, G & H: Female tails of Tuticorin population.

part gradually expanding to form the basal expanded portion which occupies one-third or more of the total esophageal length (about one-half according to Thorne, 1939). The slender part narrowing slightly as it passess through the nerve ring. Expanded portion has a wide esophageal lumen, occupying about one-

fifth to one-seventh of its width. Width of expanded portion about half or less of the body width at base of esophagus and one-fourth to one-fifth of its own length. Opening of dorsal esophageal gland 123-170 μ or 61-68% of the esophageal length from the anterior end. The first pair of subventral esophageal glands open 27-32 μ from the dorsal esophageal gland opening; the second pair opens 17-20 μ below the opening of the first pair. Nerve ring 80-90 μ from the anterior end. Cardia rounded (cylindroid according to Thorne, 1939 and conoid according to Williams, 1964).

Vulva a transverse slit. Vagina 15-19 μ long or one-third to one-half the body width long, bent slightly posteriorly. Gonad mono-opisthodelphic. Anterior uterine sac rudimentary, 8-12 μ or about one-third to one-fifth body width long. Ovary reflexed, one-half to two-thirds way back to vulva. Oviduct and uterus not distinctly separated, their combined length 128-180 μ. Oocytes arranged in a single row except at the tip of ovary. Eggs 79-86 $\times$ 26-28 μ. Prerectum 35-48 μ, about twice the anal body width. Rectum 21-26 μ, about one anal body width long. Tail at first slightly convex-conoid then filiform to the terminus; length 5-9 times the anal body width. Tail tip acute or finely or smoothly rounded. Two pairs of minute caudal pores present.

Male: Adanal pair of supplements and six ventromedians arranged at irregular intervals; first ventromedian supplement a little above the range of spicules. Spicules 28 μ medially. Tail conoid, about equal to anal body width. Cuticle 6-7 μ thick on tail.

Habitats:

Tuticorin population: Soil around roots of guava, *Psidium guajava* from Tuticorin (Madras State), India; collected by Mr. Hafeezullah in January, 1965.

Kurnool population: Soil around roots of groundnuts from Kurnool (Andhra Pradesh), India; collected by Mr. J. Shah Wali in October, 1963.

Bombay population: Soil around roots of cotton plants, *Gossypium* sp. from Bombay (Maharashtra), India; collected by Mr. Azizur Rahman Jairajpuri in October, 1964.

Relationship: *Thornenema baldum* is closely related to *T. mauritianum* but differs in having a comparatively smaller body; offset, flat and strongly sclerotized lip region with characteristic bulges in the tissues below it; wide esophageal lumen; slender part of esophagus narrowing as it passes through the nerve ring; presence of a rudimentary anterior uterine sac and smaller eggs.

Discussion:

Siddiqi (1965) mentioned the following three characters to distinguish *Thornenema paradoxum* from *T. baldum*: Expanded part of esophagus measuring less than half the esophageal length in *T. paradoxum* but about one-half in *T. baldum*; vulva located at six body widths behind the base of esophagus in *T. paradoxum* and at three in *T. baldum* and the "absence" of anterior uterine sac in *T. paradoxum* and its presence in *T. baldum*. When compared with the dimensions and

description of *T. baldum* as given by Williams (1964) and as above, *T. paradoxum*, whose description is based on a single female, cannot be regarded as a valid species for the following reasons: The population of *T. baldum* described by Williams (1964) as well as the present specimens have an esophagus in which the expanded part occupies less than half to about one-third of the total esophageal length. In some specimens of the Indian populations of *T. baldum*, the vulva is up to six body widths behind the base of the esophagus. As regards the "absence" of anterior uterine sac, Siddiqi has himself clearly said in the description of *T. paradoxum* "anterior uterine sac rudimentary, less than half body width". *Thornenema paradoxum* is therefore considered a synonym of *T. baldum*.

THORNENEMA MAURITIANUM (WILLIAMS, 1959) N. COMB.
(Figs. 3 & 4)

syn. *Thornenema viriosum* Williams, 1964
T. filiforme Siddiqi, 1965
T. delhiensis Prasad & Chawla, 1965
T. africanum Andrássy, 1965
Chrysonema mauritiana Williams, 1959

Description:

Female: Body cylindroid, gradually tapering anterior to the slender part of esophagus; slightly curved in Aligarh populations while in the Kurnool and Andamans populations it is curved only in the posterior half of the body. Cuticle smooth, its thickness varies between 1-3 μ at various places in the body. Subcuticle with faint striations, less than 1 μ thick. Lip region narrow, amalgamated, rounded, lightly sclerotized, only very slightly set off from body; width of lip region about one-fourth the width of body at base of esophagus. Labial papillae visible. Lateral chords granular, one-fifth to one-seventh of the body width at base of esophagus, 5-7 μ wide. Lateral body pores not seen. Amphids somewhat stirrup-shaped; amphidial slits 5-6 μ wide, about one-half of corresponding body width and 5-6 μ from anterior end. Sensillar pouches 18-20 μ below the amphidial slits (Fig. 3, F).

Spear 11-13 μ long, cylindrical; aperture 3-5 μ or one-third to one-fourth of spear length. Spear extension simple, straight or slightly curved with wide lumen, 15-18 μ long or about one and a half times spear length. Guiding ring apparently double in most of specimens, 6-8 μ from anterior end. Slender part of esophagus does not narrow as it passes through nerve ring. Basal expanded portion of esophagus 38-46% of total esophageal length; width about one-half of body width at base of esophagus and one-fifth to one-seventh of its own length. Esophageal lumen one-seventh to one-eighth of width of basal expanded portion. Opening of dorsal esophageal gland 144-188 μ or 55-65% of the esophageal length from the anterior end. The first pair of subventral esophageal glands open 25-42 μ from the dorsal esophageal gland opening; the second pair 16-31 μ below the opening of the first pair. Nerve ring 90-110 μ from anterior end. Cardia somewhat conoid to mammiform.

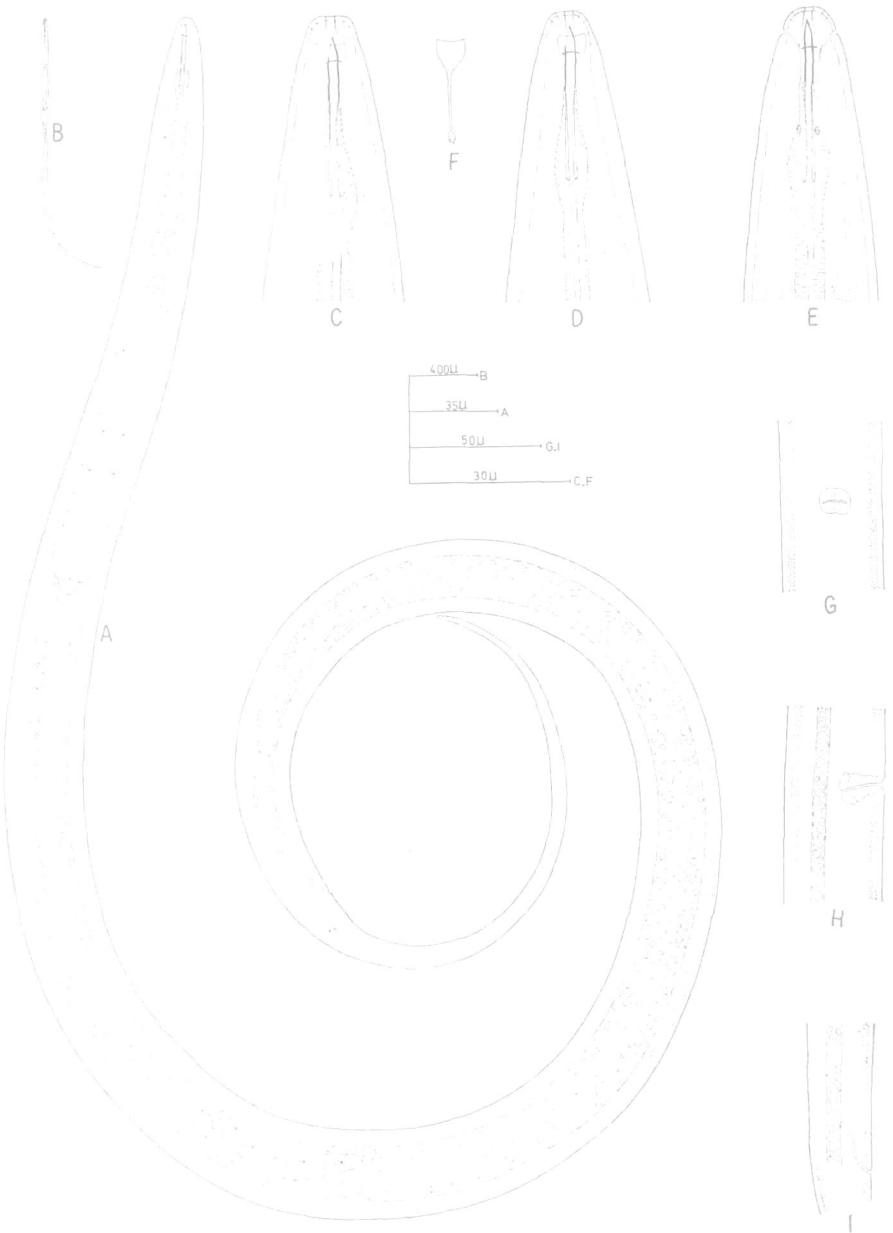

Fig. 3. *Thornenema mauritianum*: Female: A: Full length, B: Actual shape of female, C & D: Head ends, lateral, E: Head end, dorsoventral, F: Amphid, G: Vulva, H: Lateral chord at vulva, I: Lateral chord at anus.

Dimensions: See Table II.

TABLE II

Dimensions of Thornenema mauritianum

Population	No.	L (in mm)	a	b	c	V/T
1. Naqvi Park, Aligarh	100 ♀♀	1.51 (1.20-1.72)	41 (31-48)	5.4 (4.2-6.0)	7 (5-16)	33^{9} $(29\text{-}38^{7\text{-}13})$
2. Zoology Dept., Aligarh	25 ♀♀	1.42 (1.30-1.55)	43 (38-48)	5.7 (4.4-6.6)	6 (5-10)	32^{11} $(30\text{-}35^{7\text{-}15})$
3. Kurnool	6 ♀♀	1.46 (1.40-1.60)	46 (43-49)	5.4 (5.1-5.7)	8 (7-8)	34^{8} $(32\text{-}35^{7\text{-}10})$
4. Andamans	8 ♀♀	1.56 (1.30-1.60)	44 (43-48)	5.0 (4.1-5.3)	6 (5-9)	31^{9} $(30\text{-}35^{8\text{-}11})$
5. Mathura	4 ♀♀	1.52 (1.46-1.70)	44 (43-45)	5.7 (5.5-5.9)	6 (6-7)	33^{9} $(32\text{-}34^{7\text{-}12})$
6. Aurangabad	1 ♀	1.40	36	5.0	8	33^{8}
7. Malaysia	20 ♀♀	1.52 (1.30-1.60)	49 (44-53)	5.5 (5.1-6.0)	7 (6-7)	32^{8} $(27\text{-}34^{7\text{-}10})$
8. Williams, 1959 (*C. mauritiana*)	4 ♀♀	1.40 (1.00-1.60)	34 (25-39)	4.8 (4.6-5.3)	7 (7-8)	34^{9} (33-36)
9. Williams, 1964 (*T. ririosum*)	5 ♀♀	1.60 (1.54-1.70)	41 (40-46)	5.3 (5.2-5.8)	8 (7-9)	34 (32-35)
10. Siddiqi, 1965 (*T. filiforme*) Cuddalore	4 ♀♀	1.34-1.60	46-52	4.7-5.8	5	31-32
11. Siddiqi, 1965 (*T. filiforme*) Vangaon	1 ♀	1.67	43	5.1	6	33
12. Siddiqi, 1965 (*T. filiforme*) Aligarh	1 ♀	1.51	41	5.2	6	32
13. Prasad & Chawla, 1965 (*T. delhiense*)	10 ♀♀	1.63-2.01	40-49	5.4-6.7	6-7	29-34
14. Andrássy, 1965 (*T. africanum*)	2 ♀♀	1.50-2.00	40-49	5.4-6.7	6-7	28-37

Vulva transverse. Vagina 13-17 μ long, extending less than one-half across the body. Gonad mono-opisthodelphic. Combined length of oviduct and uterus 89-210 μ. No sperms in uterus. Eggs 126-138 $\times$ 24-26 μ. Anterior sexual branch absent. Prerectum 42-63 μ long, two to three times the anal body width. Rectum 22-23 μ long, one to one and a half times the anal body width. In some specimens tail is elongate-conoid and only 4-6 anal body widths long with bluntly rounded terminus; in others it is 6-8 anal body widths long with clavate or rounded terminus. In most specimens tail is 10-14 anal body widths long, filiform with smoothly rounded terminus. Length of tail varies between 80-279 μ. Two caudal

Fig. 4. *Thornenema nazilliaum*: A-E: Female gonads, F-N: Variations in length and shape of tail in Naqvi park, Aligarh population.

pores present. Tubular organs extending into intestine lumen from prerectum described by Williams (1959) for *Chrysonema mauritiana* and by Andrássy (1965) for *Thornenema africanum* faintly visible in some specimens of the present populations.

Habitats:

Naqvi park, Aligarh population: Soil around roots of *Canna* sp. and *Hordeum vulgare* from Aligarh (U.P.), India; collected by Q. H. Baqri in November, 1965.

Zoology Department, Aligarh population: Soil around roots of cotton, *Gossypium hirsutum* from Aligarh (U.P.), India; collected by Q. H. Baqri in April, 1966.

Kurnool population: Soil around roots of groundnuts from Kurnool (Andhra Pradesh), India; collected by Mr. J. Shah Wali in October, 1963.

Andamans population: Soil around roots of papaya, *Carica papaya* from Andamans, India; collected by Mr. K. K. Warriar in February, 1966.

Mathura population: Soil around roots of cotton, *Gossypium hirsutum* from Kisera, District Mathura (U.P.), India; collected by Qaiser H. Baqri in September, 1966.

Aurangabad population: Soil around rhizoids of mosses, *Funaria* sp. from Aurangabad (Maharashtra), India; collected by M. S. Jairajpuri.

Malaysia population: Soil around roots of rubber plants from Penang, Malaysia; collected by Prof. M. Mozammil in June, 1964.

Relationship: *Thornenema mauritianum* is closest to *T. baldum*, *T. lissum* and *T. sylphoides*. The characters distinguishing *T. mauritianum* from *T. baldum* have already been given above. From *T. lissum* it differs in having a comparatively more sclerotized lip region, shape of amphids and absence of the anterior uterine branch. From *T. sylphoides* it is differentiated by its small and differently shaped tail and transverse vulva (vulva circular in *T. sylphoides*).

Discussion:

The species *Thornenema mauritianum* was originally described by Williams (1959) in the genus *Chrysonema* Thorne, 1929. From Williams' descriptions and illustrations it is quite evident that it has more resemblance to the genus *Thornenema* in having a narrow, amalgamated and sclerotized lip region and mono-opisthodelphic gonad. A paratype specimen of *C. mauritiana* was kindly supplied by Rothamsted Experimental Station and a study of this specimen confirmed that the species certainly belongs in the genus *Thornenema*. Some paratypes of *T. viriosum* sent by Mr. D. J. Hooper were also examined and found to be identical with *T. mauritianum*. *Thornenema viriosum* is therefore regarded as a synonym of *T. mauritianum*.

Thornenema filiforme, *T. delhiense* and *T. africanum* are closely related to each other and are also very similar to *T. mauritianum*. *Thornenema filiforme*

falls well within the dimensions and description of *T. mauritianum* as given above and is therefore regarded as its synonym. The type specimens of *T. delhiense* obtained through the Indian Agricultural Research Institute, New Delhi and also specimens of this species collected from the type locality do not show the knobbed spear extension, cylindroid esophagus and three pairs of caudal papillae as illustrated and described by Prasad & Chawla (1965). These specimens also fit perfectly well with *T. mauritianum* and are its synonym. Similarly, there are no valid characters to separate *T. africanum* from *T. mauritianum* and it should also be regarded as a synonym.

GENUS THORNENEMA ANDRÁSSY, 1959

Diagnosis (emended): Dorylaiminae. Lip region narrow, amalgamated and sclerotized. Spear cylindrical; spear extension simple, hollow rod-like; spear guiding ring appearing single or double. Basal expanded portion of esophagus one-third to half of the total esophageal length. Vulva pre-equatorial. Female gonad mono-opisthodelphic. Supplements consist of an adanal pair and a non-contiguous ventromedian series. Tail different in the two sexes, elongate-conoid with a filiform terminus in females and short bluntly-conoid in males.

Type species: *Thornenema lissum* (Thorne, 1939) Andrássy, 1959.

Relationship: The genus *Thornenema* is very close to the genus *Mesodorylaimus* Andrássy, 1959 but can be differentiated in having narrow, amalgamated, sclerotized lip region and mono-opisthodelphic gonad.

KEY TO THE SPECIES OF THORNENEMA

1. Spear length twice the head width; tail constricted on both sides behind the anus . . . . . *laevicapitatum*
   Spear length less than two head widths; tail unconstricted or constricted only on dorsal side . . 2
2. V = >40; tail constricted on dorsal side . . . . . *catalcantii*
   V = <40; tail unconstricted 3
3. Amphids twice as long as wide . . . . . *lissum*
   Amphids about as long as wide 4
4. c = <4; vulva circular . . . . . *sylphoides*
   c = >5; vulva transverse 5
5. L = <0.7 mm; spear 9 μ . . . . . *thienemanni*
   L = >0.8 mm; spear >10 μ 6
6. Head strongly sclerotized, truncated; anterior uterine sac present . . . . . *baldum*
   Head not strongly sclerotized, rounded; anterior uterine sac absent . . . . . *mauritianum*

GENUS WILLINEMA N. GEN.

Diagnosis: Dorylaiminae. Same as *Thornenema*. Tail hemispheroid. Males unknown.

Type species: *Willinema parvum* (Williams, 1959) n. comb.

syn. *Labronema parvum* Williams, 1959
Thornenema parvum (Williams, 1959) Williams, 1964
Eudorylaimus parvus (Williams, 1959) Andrássy, 1959

Other species: *W. indicum* n. sp.

Relationship: The genus *Willinema* is closely related to *Mesodorylaimus, Thornenema* and *Labronema*. From *Mesodorylaimus* it differs in the form of the lip region, in having mono-opisthodelphic gonad and rounded tail. From *Thornenema* it differs in the shape of the female tail. From *Labronema* it is differentiated in the shape of lip region and number of gonads.

KEY TO MESODORYLAIMUS, THORNENEMA, WILLINEMA AND LABRONEMA

1. Female tail rounded 2
   Female tail elongate-conoid with a long filiform terminus 3
2. Lip region narrow, amalgamated and sclerotized; ovary single . . . . . *Willinema*
   Lip region not sclerotized, prominent with six inarching lip flaps; ovaries paired . *Labronema*
3. Lip region narrow, amalgamated and sclerotized; ovary single . . . . . *Thornenema*
   Lip region not so narrow and amalgamated and unsclerotized; ovaries paired . *Mesodorylaimus*

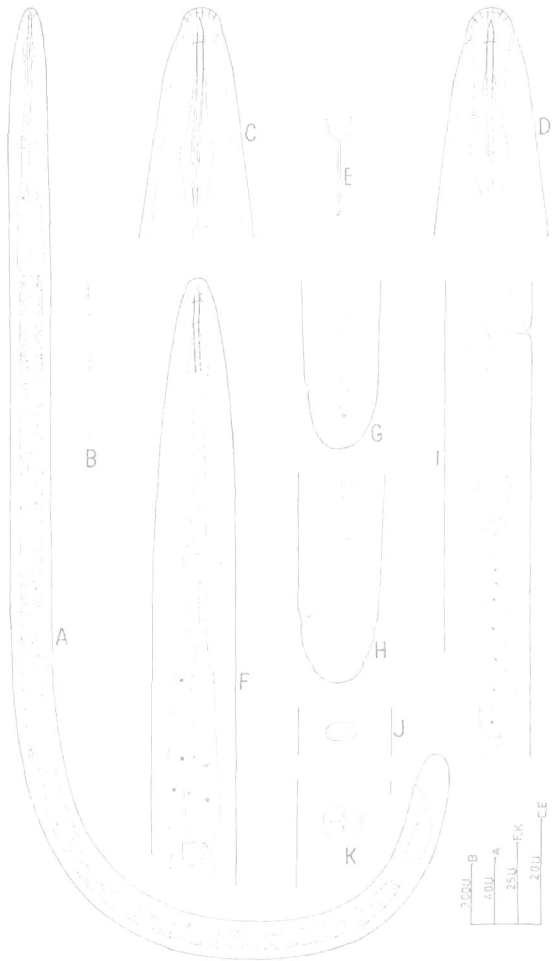

Fig. 5. *Willinema indicum* n. gen., n. sp. Female: A: Full length, B: Actual shape of female, C: Head end, lateral, D: Head end, dorsoventral, E: Amphid, F: Esophageal region, G: Tail, lateral, H: Tail, dorsoventral, I: Gonad, J & K: Vulva.

WILLINEMA INDICUM N. SP.
(Fig. 5)

Dimensions:

16 ♀♀: L = 0.83 mm (0.76-0.90 mm); a = 33 (28-37); b = 5.0 (4.0-5.7); c = 44 (41-50); V = 48^{13} ($45\text{-}52^{10\text{-}17}$).
Holotype: L = 0.87 mm; a = 35; b = 5.2; c = 44; V = 49^{13}.

Description:

Female: Body cylindroid, tapering gradually anterior to slender part of esophagus. Cuticle smooth, its thickness varies between 1-6 μ at various places in the body. Subcuticle with faint striations, less than 1 μ thick. Lip region narrow, amalgamated, slightly set off by a depression and about one-fourth of body width at base of esophagus. Labial papillae visible, but do not modify contour of lip region. Lateral chords distinct, vacuolated and one-fifth to one-sixth of body width near middle. Amphids cup-like, their apertures occupying more than one half of corresponding body width, 4-5 μ from anterior end. Sensillar pouches 16-17 μ from amphidial slits.

Spear 9-11 μ, cylindrical; aperture occupying more than one-fourth of spear length. Guiding ring 6-7 μ from anterior end, single. Spear extension 14-16 μ long, simple. Basal expanded portion of esophagus occupies about one-third of total esophageal length. Width of basal expanded portion about two-thirds of body width at base of esophagus and about one-fourth of its own length. Opening of dorsal esophageal gland 98-118 μ or 65-68% of the esophageal length from the anterior end. The first pair of subventral esophageal glands opens 26-28 μ behind the dorsal esophageal gland opening; the second pair opens 11-13 μ behind the opening of the first pair. Nerve ring 76-86 μ from the anterior end. Cardia hemispheroid.

Vulva a transverse slit. Vagina 11-14 μ, about one-half body width long. Combined length of uterus and oviduct 100-158 μ. Ovary with flexure. Anterior uterine branch about half corresponding body width long. Oocytes arranged in a single row, except at tip of ovary. Prerectum 35-54 μ or two to three anal body widths. Rectum 18-22 μ long, about equal to one anal body width. Tail hemispheroid, about one anal body width long. Two pairs of minute caudal pores present.

Males: Not found.

Habitat: Soil around roots of cotton plants, *Gossypium* sp. from Tuticorin (Madras State), India.

Type specimens: Collected by Mr. Hafeezullah in January, 1965; holotype mounted on slide MSJ/*Will. indicum*/1; 16 paratypes on slides MSJ/*Will. indicum*/2-5; deposited in the Zoology Museum of Aligarh Muslim University, Aligarh (U.P.), India.

Differential diagnosis: *Willinema indicum* n. sp., differs from *W. parvum* in having a shorter body, narrower lip region, smaller spear and spear extension

(spear and spear extension each 14-15 μ long in *W. parvum*), single guiding ring (double guiding ring in *W. parvum*), a shorter esophagus (b = 3.6 (3.5-4.0) in *W. parvum*), the basal expanded portion of esophagus occupying only one-third or less of the total esophageal length (one-half in *W. parvum*).

We are highly thankful to Mr. David J. Hooper for kindly supplying us the paratypes of *Chrysonema mauritiana, Thornenema viriosum, T. sylphoides* and *Labronema parvum* and to Dr. S. K. Prasad for paratypes of *T. delhiense*. The first author gratefully acknowledges the financial assistance provided to him by the Indian council of Agricultural Research, New Delhi.

ZUSAMMENFASSUNG

Eine Revision der Gattung Thornenema *Andrássy 1959 und der Vorschlag von* Willinema *n. gen.*

Thornenema baldum wird wiederbeschrieben. Zugleich wird zum ersten Male eine Beschreibung des Männchens gegeben. *T. paradoxum* wird mit *T. baldum* synonymisiert. *Chrysonema mauritiana* wird in die Gattung *Thornenema* überführt. *Thornenema viriosum, T. filiforme, T. africanum* und *T. delhiensis* werden als Synonyme zu *T. mauritiana* angesehen. Es werden eine verbesserte Diagnose, die verwandtschaftlichen Beziehungen sowie ein Schlüssel zur Bestimmung der gültigen Arten von *Thornenema* mitgeteilt. Für *Thornenema parvum* wird die neue Gattung *Willinema* n. gen. vorgeschlagen, die sich durch die Schwanzform von *Thornenema* unterscheidet. *Willinema indicum* n. sp. aus Tuticorin, Südindien, wird beschrieben.

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On Six New Species of Dorylaimida (Nematoda)

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Six new species of Dorylaimida are described here : Two each belonging to *Discolaimium* Thorne, 1939 and *Aporcelaimellus* Heyns, 1965 and one each to *Leptonchus* Cobb, 1920 and *Amphidelus* Thorne, 1939. All the specimens studied were fixed in formalin and mounted in glycerine.

Discolaimium mazhari n.sp.
(Fig. 1, A–E)

Measurements : 4 ♀♀ : L=1·19 mm. (1·11–1·27 mm.) ; a=36 (30–41) ; b=4·0 (3·8–4·3) ; c=61 (60–64) ; V=$^{6}43^{6}$ ($^{5-7}42-44^{6-7}$). Holotype (♀) : L=1·21 mm. ; a=30 ; b=3·9 ; c=61 ; V=$^{6}45^{7}$.

Description : Body cylindroid, tapering gradually anterior to slender part of oesophagus and slightly curved in the posterior half of its length. Cuticle smooth, its thickness varies between 1–3 μ at various places in the body (3 μ thick at tail). Subcuticle with faint striations, less than 1 μ thick. Head well set off, wider than the adjoining body, its diameter two-thirds to two-fifths of the body width at base of oesophagus. Lips distinctly modifying the head contour. Lateral chords one-fourth to one-sixth of body width near middle. Lateral glandular organs conspicuous, 75–82 in number, irregular in size and arrangement. Amphids cup-like, their apertures 4–5 μ from anterior end, occupy 5–6 μ or about one-half of the corresponding body width. Sensillar pouches not visible.

Spear 11–12 μ long, aperture more than half of its length. Guiding ring 5–6 μ from anterior end. Spear extension 21–22 μ, simple. Basal expanded portion of oesophagus occupies 55–56% of total oesophageal length, its width slightly more than one-half of body width at base of oesophagus and one-eighth to one-tenth of its own length. Opening of dorsal oesophageal gland 153–157 μ or 48–52% of the oesophageal length from the anterior end. The first pair of subventral oesophageal glands open 56–72 μ from the dorsal oesophageal gland opening ; the second pair opens 29–37 μ below the opening of the first pair. Nerve ring 85–94 μ from anterior end. Cardia spatulate, with two lobes at the sides.

Vulva transverse. Vagina 10–13 μ, extending one-third to one-fourth across the body. Gonads amphidelphic. Combined length of oviduct and uterus 62–80 μ and 68–81 μ of the anterior and posterior gonads respectively. No sperms in uteri. Ovaries with single flexure ; oocytes arranged in a single row except at the tip. Prerectum 15–19 μ, less than one anal body width. Rectum 18–20 μ, about one anal body width long. Tail hemispheroid, swollen, and about one anal body width long. Two minute caudal pores present.

Male : Not found.

Habitat : Soil around roots of cotton, *Gossypium* sp. from Disond Hakimpur, District Bijnor (U.P.), India.

Type Specimens : Collected by Mr. Mohd. Mazhar Ahsan in November, 1966 ; holotype mounted on slide MSJ/*Discolaimium mazhari*/1 ; 4 paratypes on slide MSJ/*Discolaimium mazhari*/2 ; deposited in the Zoology Museum of Aligarh Muslim University, Aligarh (U.P.), India.

Differential Diagnosis : *Discolaimium mazhari* n.sp., comes close to *D. cylindricum* Thorne, 1939 and *D. pseudoporum* Fielding, 1950. From the former it differs in having spear aperture more than half of spear length, glandular organs 75–82 (40–60 in *D. cylindricum*) and a swollen tail. From *D. pseudoporum* it differs in having shorter body length, glandular organs 75–82 (45–55 in *D. pseudoporum*), spear aperture more than half of spear length, shorter prerectum, absence of axial terminal pore-like structure and longer tail.

Discolaimium upum n.sp.
(Fig. 1, F–I)

Measurements : 7 ♀♀ : L=0·84 mm. (0·78–0·89 mm.) ; a=38 (36–42) ; b=4·0 (3·5–4·5) ; c=44 (41–47) ; V=$^{7}47^{8}$ ($^{6-9}45-48^{6-10}$). Holotype (♀) : L=0·86 mm. ; a=39 ; b=4·4 ; c=47 ; V=$^{7}44^{8}$.

Description : Body cylindroid, tapering gradually anterior to slender part of oesophagus and curved from behind the base of oesophagus. Cuticle smooth, about 1 μ thick. Subcuticle with faint striations, less than 1 μ thick. Head set off from the body by a constriction, its width less than one-half to two-fifths of body width at base of oesophagus. Lips conoid, modifying the head contour.

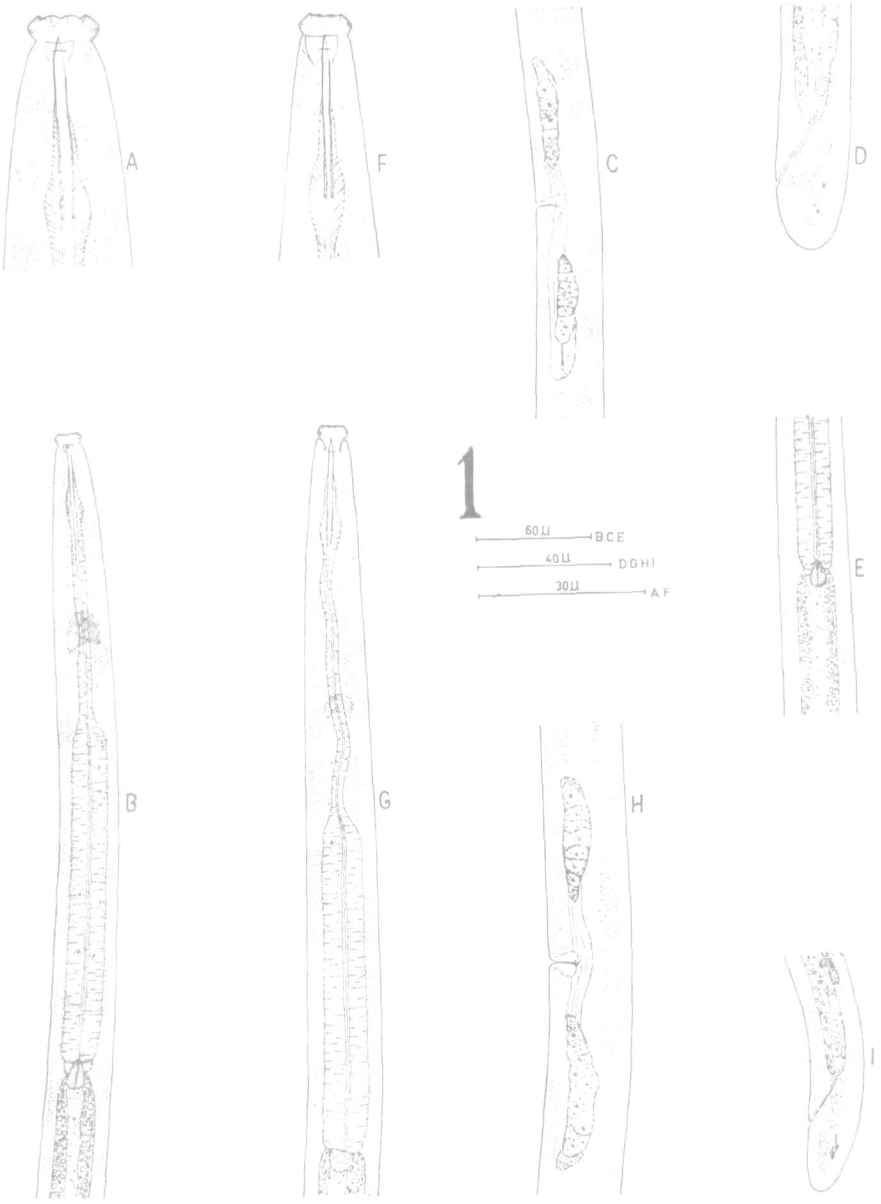

Fig. 1. A–E.—*Discolaimium mazhari* n.sp. A—Head end. B—Oesophageal region. C—Reproductive organs. D—Tail end. E—Cardia region showing modification. F–I.—*Discolaimium upum* n.sp. F.—Head end. G.—Oesophageal region. H.—Reproductive organs. I.—Tail end.

Lateral chords distinct, one-fifth to one-sixth of body width near middle. Lateral glandular organs conspicuous, 35–40 in number, irregular in size and arrangement. Amphids cup-like, their apertures 4 μ from anterior end, occupy 5–6 μ or more than half the corresponding body width. Sensillar pouches 20–22 μ from amphidial slits.

Spear 10–12 μ long, aperture less than half of its length. Guiding ring 5–6 μ from anterior end. Spear extension 14–16 μ, simple. Basal expanded portion of oesophagus occupies 45–50% of total oesophageal length, its width more than half of body width at base of oesophagus and one-seventh to one-ninth of its own length. Opening of dorsal oesophageal gland 111–130 μ or 56–60% of the oesophageal length from the anterior end. The first and second pair of subventral oesophageal glands and their openings not visible. Nerve ring 73–84 μ from anterior end. Cardia hemispheroid.

Vulva a transverse slit. Vagina 8–10 μ, about one-third across the body. Gonads amphidelphic. Combined length of oviduct and uterus 54–61 μ and 57–82 μ of the anterior and posterior sexual branches respectively. No sperms in uteri. Ovaries with single flexure ; oocytes arranged in a single row except at the tip. Prerectum 43–54 μ, three to four anal body widths long. Rectum 11–16 μ, about one anal body width long. Tail tapers slightly to bluntly rounded terminus, about one and a half anal body widths long. Two minute caudal pores present.

Male : Not found.

Habitat : Soil around roots of cotton, *Gossypium* sp. from Sanna, District Etah (U.P.), India.

Type Specimens : Collected by Mr. Wahid Husain in November, 1966 ; mounted on slide MSJ/*Discolaimium upum*/1 ; deposited in the Zoology Museum of Aligarh Muslim University.

Differential Diagnosis : *Discolaimium upum* n.sp., comes close to *D. sublatum* Heyns, 1963 and *D. latum* Thorne, 1939. From the former it differs in having slightly shorter spear, more glandular organs (25 in *D. sublatum*), amphids more than half as wide as head (half as wide in *D. sublatum*) and prerectum three to four anal body widths long (only one anal body width long in *D. sublatum*). From *D. latum* it differs in having spear longer than head width and guiding ring posterior to head constriction (spear less than head width and guiding ring anterior to head constriction in *D. latum*), slender body (a=24 in *D. latum*), slightly longer tail (about one anal body width long in *D. latum*) and anterior position of vulva (V=54 in *D. latum*).

Key to Species of *Discolaimium*

1. Ovary single 2
   Ovaries paired 3
2. Lateral glandular organs distinctly present.....
   ..... *smithi* (Heyns, 1963) Timm and Bhuiyan, 1963
   Lateral glandular organs absent.....
   ..... *monohystera* Siddiqi, 1965
3. Tail rounded..... 4
   Tail conoid 9
4. Body length 1·7 mm. ; c=80–100.....
   ..... *pseudoporum* Fielding, 1950
   Body length 1·3 mm. or less ; c=59 or less..... 5
5. Spear aperture more than half of spear length ; tail end slightly swollen ..... *mazhari* n.sp.
   Spear aperture half or less of spear length ; tail end not swollen 6
6. Body length 1·3 mm. ; c=59.....*cylindricum* Thorne, 1939
   Body length 0·9 mm. or less ; c=51 or less..... 7
7. Spear length less than head width ; guiding ring anterior to head constriction.....*latum* Thorne, 1939
   Spear length equal to or slightly more than head width ; guiding ring posterior to head constriction..... 8
8. Spear length 14 μ ; glandular organs 25 ; prerectum about one anal body width long.....*sublatum* Heyns, 1963
   Spear length 11–12 μ ; glandular organs 35–40 prerectum three to four anal body widths long.....*upum* n.sp.
9. Lateral glandular organs distinctly present..... 10
   Lateral glandular organs indistinct or absent.....13
10. Tail ventrally arcuate ; c<25..... 11
    Tail not ventrally arcuate ; c4>1..... 12
11. Body length 1·1 mm. ; a=39.....*gracile* Thorne, 1939
    Body length 1·5 mm. ; a=55–58.....
    .....*arcuicaudatum* Furstenberg and Heyns, 1965
12. Body length 2·2 mm.....*gigas* Fielding, 1950
    Body length 1·25–1·56 mm. ..... *simplex* Siddiqi, 1965
13. Ellipsoidal swelling at junction of spear extension and oesophageal lumen double.....*tenue* Furstenberg and Heyns, 1965
    Ellipsoidal swelling at junction of spear extension and oesophageal lumen single..... 14
14. Body length 1·8 mm.....
    .....*bulbiferum* (Cobb, 1906) Timm and Bhuiyan, 1963
    Body length 1·6 mm. or less..... 15
15. Spear aperture about half of spear length ; c=39.....
    .....*conura* Thorne, 1939
    Spear aperture more than half of spear length ; c=48–54.....
    .....*paraconura* Siddiqi, 1965

Aporcelaimellus heynsi n.sp.
(Fig. 2, A–G)

Measurements : Ajitgunj population : 3 ♀♀ : L=0·90–1·16 mm. ; a=32–34 ; b=3·5–4·0 ; c=32–34 ; V=$^{6-10}53-55^{7-9}$. Holotype (♀) : L=1·12 mm. ; a=31 ; b=4·0 ; c=31 ; V=$^{6}55^{7}$.

Mukhtarpur population : 3 ♀♀ : L=1·10–1·20 mm. ; a=32–34 ; b=3·7–4·0 ; c=31–34 ; V=$^{7-9}51-54^{7-8}$.

Iglas population : 11 ♀♀ : L=1·10 mm. (0·98–1·22 mm.) ; a=32 (29–34) ; b=4·1 (3·4–4·3) ; c=34 (28–39) ; V=$^{7}53^{9}$ ($^{6-11}51-56^{7-10}$).

Description : Body cylindroid, tapering gradually anterior to slender part of oesophagus and curved in posterior third of its length. Cuticle marked with faint striations, 1–4 μ thick at various places in the body (on tail 4 μ thick). Subcuticle distinctly striated, less than 1 μ thick. Lip region well set off from body, its width about one-third of the body width at base of oesophagus (a female from Mukhtarpur population has narrower and slightly differently shaped lip region, Fig. 2, C). Lips conoid, modifying the head contour. Labial papillae distinct. Lateral chords granular, one-fourth to one-fifth of body width near middle. Lateral, dorsal and ventral body pores not visible. Amphids cup-like, their apertures 4 μ from anterior end occupy 6–7 μ or more than half of the corresponding body width. Sensillar pouches 16–18 μ from amphidial slits.

Spear 11–13 μ long, aperture 7–9 μ. Guiding ring 5–6 μ from anterior end. Spear extension 17–19 μ, simple. Basal expanded portion of oesophagus occupies 45–50% of total oesophageal length, its width about one-half of body width at base of oesophagus and one-sixth to one-ninth of its own length. Opening of dorsal oesophageal gland 145–190 μ or 55–59% of the oesophageal length from anterior end. The first pair of subcentral oesophageal glands open 43–48 μ from the dorsal oesophageal gland opening ; the second pair opens 23–26 μ below the opening of the first pair. Nerve ring 86—95 μ from anterior end. Oesophago-intestinal disc present. Cardia hemispheroid.

Vulva pore-like. Vagina 10–14 μ, about one-third across the body. Gonads amphidelphic. Combined length of oviduct and uterus 72–133 μ and 82–115 μ of the anterior and posterior gonads

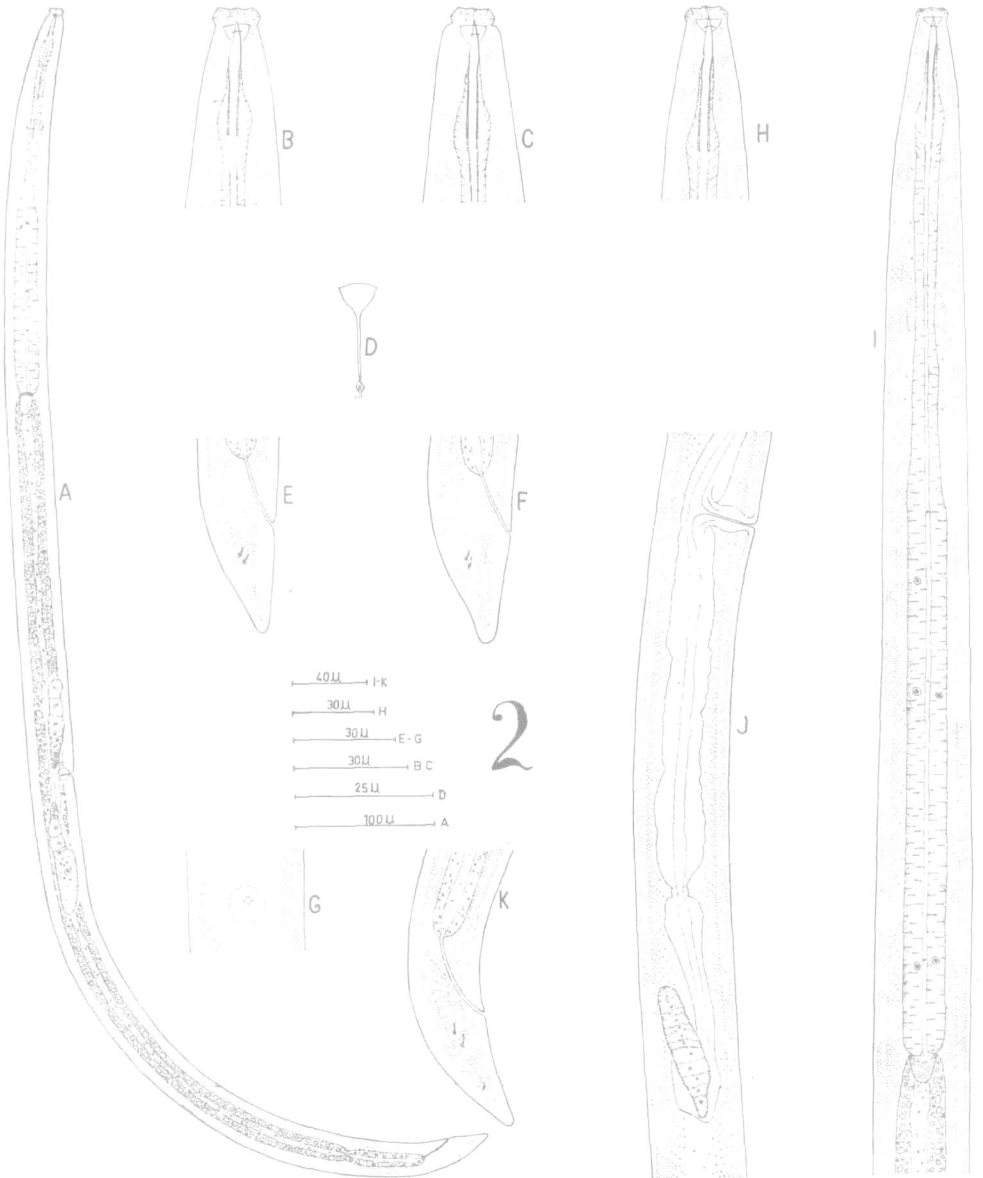

Fig. 2. A–G.—*Aporcelaimellus heynsi* n.sp. A.—Female, full length. B.—Head end. C.—Head end showing modification (Mukhtarpur population). D.—Amphid. E, F.—Tail ends. G.—Vulva, dorsoventral. H–K.—*Aporcelaimellus indicus* n.sp. H.—Head end. I.—oesophageal region. J.—Reproductive organs. K.—Tail end.

respectively. No sperms in uteri. Ovaries with single flexure; oocytes arranged in a single row except at the tip. Egg 90–92 × 33–34 μ. Prerectum 52–75 μ, two and a half to four anal body widths long. Rectum 21–24 μ, about one anal body width long. Tail conoid, terminus rounded, 29–41 μ or one and a half to two anal body widths long. Two minute caudal pores present.

Male : Not found.

Habitat : Ajitgunj population : Soil around roots of cotton, *Gossypium* sp. from Ajitgunj, District Mainpuri (U.P.), India.

Mukhtarpur population : Soil around roots of cotton, *Gossypium* sp. from Mukhtarpur, District Bijnor (U.P.), India.

Iglas population : Soil around roots of cotton, *Gossypium* sp. from Iglas, District Aligarh (U.P.), India.

Type Specimens : Ajitgunj population : Collected by Mr. Wahid Husain ; mounted on slide MSJ/*Aporcelaimellus heynsi*/1 ; *Mukhtarpur population* : Collected by Qaiser H. Baqri ; on slide MSJ/*Aporcelaimellus heynsi*/2 and Iglas population: Collected by Mr. Intizar Husain ; on slide MSJ/*Aporcelaimellus heynsi*/3, 4, 5. All these specimens were collected in the month of November, 1966 and are deposited in the Zoology Museum of Aligarh Muslim University.

Differential Diagnosis : *Aporcelaimellus heynsi* n.sp., comes close to *A. paraconicaudatus* (Meyl, 1956) Heyns, 1965 but differs in having a shorter spear (spear 16 μ in *A. paraconicaudatus* as calculated from Meyl's figures) ; slender body (a=21–22 in *A. paraconicaudatus*) and differently shaped tail.

Aporcelaimellus indicus n.sp.
(Fig. 2, H–K)

Measurements : 3 ♀♀ : L=2·40–2·45 mm. ; a=49–50 ; b=4·7 ; c=41–43 ; $^{13-16}57-58^{12-13}$. Holotype (♀) : L=2·42 mm. ; a=49 ; q=4·7 ; c=42 ; V=$^{15}58^{13}$.

Description : Body stout, cylindroid, tapering gradually anterior to slender part of oesophagus and curved posterior to vulva. Cuticle smooth, its thickness varies between 2–6 μ at various places in the body. Subcuticle marked with fine striations, less than 1 μ apart. Lip region marked off from the body by a depression, wider than the adjoining body and about one-third as wide as body width at base of oesophagus. Lips low and somewhat angular. Labial papillae visible. Lateral chords less than one-fourth body width near middle.

Lateral, dorsal and ventral body pores not seen. Amphids broad and shallow, their apertures 4 μ from anterior end occupy 9–10 μ or about three-fifths of the corresponding body width. Sensillar pouches not seen.

Spear 16 μ long, aperture 9–10 μ. Guiding ring thick, 7 μ from anterior end. Spear extension 34–35 μ, simple. Anterior slender part of oesophagus 12–14 μ wide, not well demarcated from the posterior expanded portion, narrowing slightly as it passes through the nerve ring. Basal expanded portion of oesophagus occupies 56–57% of total oesophageal length, its width less than half of body width at base of oesophagus and about one-sixteenth of its own length. Opening of dorsal oesophageal gland 300–310 μ or 56–58% of the oesophageal length from anterior end. The first pair of subventral oesophageal glands open 90–98 μ from the dorsal oesophageal gland opening ; the second pair opens 145–150 μ below the opening of the first pair. Nerve ring 148–150 μ from anterior end. A cushion-shaped oesophago-intestinal disc present. Cardia hemispheroid.

Vulva pore-like. Vagina 28 μ, extending three-fifths across the body. Gonads amphidelphic. Oviduct and uterus distinctly separated by a sphincter in both the sexual branches. Combined length of oviduct and uterus 367–380 μ and 306–320 μ of the anterior and posterior gonads respectively. No sperms in uteri. Ovaries with single flexure ; oocytes arranged in a single row except at the tip. Prerectum 125–128 μ or about four times the anal body width. Rectum 40–42 μ, more than one anal body width long. Tail 56–60 μ, slightly less than twice the anal body width, conoid, ventrally arcuate with rounded tip. Two pairs of minute caudal pores present.

Male : Not found.

Habitat : Soil around roots of cotton, *Gossypium hirsutum* from Ajitgunj, District Mainpuri (U.P.), India.

Type Specimens : Collected by Mr. Wahid Husain in November, 1966 ; holotype mounted on slide MSJ/*Aporcelaimellus indicus*/1 ; paratypes on slides MSJ/*Aporcelaimellus indicus*/2, 3 ; deposited in the Zoology Museum of Aligarh Muslim University.

Differential Diagnosis : *Aporcelaimellus indicus* n.sp. comes close to *A. williamsi* Heyns, 1965 and *A. mamillatus* (Williams, 1959) Heyns, 1965. From the former it differs in having low lips, shorter spear (spear 20 μ in *A. williamsi*) and tail longer and differently shaped (tail less than one anal body width long and bluntly conoid in *A. williamsi*). From *A. mamillatus* it differs in having

slender body (a=20–30 in *A. mamillatus*), shorter spear (20–27 μ long in *A. mamillatus*), spear aperture comparatively large (about half the spear length in *A. mamillatus*) and differently shaped tail (tail with a teat-like terminus in *A. mamillatus*). Males are known for both *A. williamsi* and *A. mamillatus* while they were not found in *A. indicus* and sperms were also not seen in its uteri.

Key to Species of *Aporcelaimellus*

1. Amphids duplex 2
   Amphids not duplex 3
2. Length 3·0 mm.....
   .....*obscurus* (Thorne and Swanger, 1936) Heyns, 1965
   Length 2·0 mm. .....
   .....*amylovorus* (Thorne and Swanger, 1936) Heyns, 1965
3. Amphids broad and shallow..... 4
   Amphids narrow and deep..... 6
4. Tail convex-conoid, with a teat-like terminus .....
   .....*mamillatus* (Williams, 1959) Heyns, 1965
   Tail conoid, without a teat-like terminus..... 5
5. Spear 20 μ ; tail less than one anal body width long.....
   .....*williamsi* Heyns, 1965
   Spear 16 μ ; tail about two anal body widths long.....
   ..... *indicus* n.sp.
6. Body length less than 1·4 mm. ; c=less than 40..... 7
   Body length more than 1·5 mm. ; c=more than 48..... 8
7. Spear 16 μ ; a=21–22.....
   .....*paraconicaudatus* (Meyl, 1956) Heyns, 1965
   Spear 11–13 μ ; a=28–39.....*heynsi* n.sp.
8. Tail bluntly rounded 9
   Tail conoid 10
9. Length 1·8–2·0 mm. ; spear aperture 65% of spear length.....
   .....*vanderlaani* (Meyl, 1957) Heyns, 1965
   Length 2·5 mm. ; spear aperture about 50% of spear length
   .....*krygeri* (Ditlevsen, 1928) Heyns, 1965
10. Tail one and a half anal body width long ; a=41.....
    .....*capitatus* (Thorne and Swanger, 1936) Heyns, 1965
    Tail about one anal body width long ; a=33 or less..... 11
11. Tail convex-conoid ; length 2·8 mm. .....
    .....*nivalis* (Altherr, 1952) Heyns, 1965
    Tail conoid, terminus dorsally bent ; length less than 2·4 mm.
    12

12. Lips angular ; a=18–22 ; spear aperture more than 50% of spear length ; both males and females known.....
.....*gerlachi* (Meyl, 1956) Heyns, 1965
Lips rounded ; a=33 ; spear aperture 50% of spear length ; only male known.....*seinhorsti* (Meyl, 1965) Heyns, 1965

Discussion : Both the new species of *Aporcelaimellus* described above possess oesophago-intestinal disc, although Heyns (1965) mentions that this structure is absent in *Aporcelaimellus*. However, in other characters these species fit perfectly well under *Aporcelaimellus*.

Amphidelus novus n.sp.
(Fig. 3, A–G)

Measurements : 2 ♀♀ : L=1·52–1·62 mm. ; a=66–68 ; b=5·7–5·9 ; c=6–9 ; V=$^{4-5}32$–33^{7-8}. Holotype (♀) : L=1·73 mm. ; a=59 ; b=6·1 ; c=8 ; V=$^{5}32^{6}$. 2 ♂♂ : L=1·45–1·66 mm. ; a=58–69 ; b=5·5–5·6 ; c=8–9 ; T=53.

Description

Female : Body slender, tapering gradually anterior to slender part of oesophagus. Cuticle smooth, its thickness varies between 1–2 μ at various places in the body. Subcuticle with faint striations, less than 1 μ thick. Lip region narrow, slightly marked off from body ; lips amalgamated. Width of lip region one-fifth of body width at base of oesophagus. Lateral chords one-sixth to one-seventh of body width near middle. Amphids narrow, elongate ; apertures 10–11 μ or two head widths from anterior end occupy 3–4 μ. Sensillar pouches not seen. Basal oesophageal bulb occupies 12–17% of the total oesophageal length, its width about half of body width at base of oesophagus and about one-fourth of its own length. Opening of dorsal oesophageal gland 236–244 μ or 90–91% of the oesophageal length from anterior end. The first pair of subventral oesophageal glands open 10–14 μ from the dorsal oesophageal gland opening. Nerve ring 102–107 μ from anterior end. Cardia very small, discoid.

Vulva a transverse slit. Vagina 9 μ one-third across the body. Gonads amphidelphic. Combined length of oviduct and uterus 71–92 μ and 100–143 μ of the anterior and posterior gonads respectively. Ovaries with a single flexure ; oocytes arranged in a single row except at the tip. Prerectum 51–68 μ or about four anal body widths long. Rectum 13–16 μ or about one anal body width long. Tail long, filiform, 183–241 μ or eleven to eighteen times the anal body width. Tail terminus finely rounded. Caudal pores not visible.

Male : Five ventromedian supplements arranged at irregular intervals. The first pair 10 μ above the anus, the second pair a little above the range of spicules. Spicules almost straight, 16 μ medially. Tail spirally curved, shape as in female, eleven times the anal body width.

Habitat : Soil around roots of cotton, *Gossypium* sp. from Pipalya Rayazada, District Rampur (U.P.), India.

Type Specimens : Collected by Qaiser H. Baqri in November, 1966 ; holotype and one paratype male mounted on slide MSJ/*Amphidelus novus*/1 ; 2 female paratypes and one male paratype on slides MSJ/*Amphidelus novus*/2, 3 ; deposited in the Zoology Museum of Aligarh Muslim University.

Differential Diagnosis : *Amphidelus novus* n.sp., comes close to *A. lemani* (Stefanski, 1941) Thorne, 1939 but differs in the shape and location of amphids, position of vulva (V=50 in *A. lemani*), in having straight spicules and five supplements in male (spicules sigmoid and only three supplements in *A. lemani*).

Leptonchus capitatus n.sp.
(Fig. 3, H–K)

Measurements : 7 ♀♀ : L=1·21 mm. (0·91–1·42 mm.) ; a=33 (29–39) ; b=5·2 (4·4–5·8) ; c=52 (45–60) ; V=$^{13}58^{12}$ ($^{12-14}55-62^{11-13}$). Holotype (♀) : L=1·23 mm. ; a=32 ; b=5·4 ; c=59 ; V=$^{14}58^{12}$.

Description : Body cylindroid, tapering gradually anterior to slender part of oesophagus and curved posterior to vulva. Cuticle 2 μ thick at head, 4–6 μ at tail, smooth. Subcuticle irregularly loosened, striated. Lip region cap-like, well set off from body. Labial papillae visible. Lateral chords one-sixth to one-ninth of body width near middle. Lateral, dorsal and ventral body pores not seen. Amphids cup-shaped, their apertures 4 μ from anterior end occupy 6 μ or more than half of the corresponding body width. Sensillar pouches 17–18 μ from amphidial slits. Spear 9–10 μ, slender, narrow and about one head width long. Spear extension arcuate, cuticularized, about as long as spear. Guiding ring 5–6 μ from anterior end. Basal oesophageal bulb occupies 17–21% of total oesophageal length, its width about half of the body width at base of oesophagus and about two to three times of its own length. Opening of dorsal oesophageal gland 160–202 μ or 80–86% of the oseophageal length from anterior end. The subventral pair of oesophageal glands open 8–12 μ below the dorsal oesophageal gland opening. Nerve ring 85–94 μ from anterior end. Cardia hemispheroid.

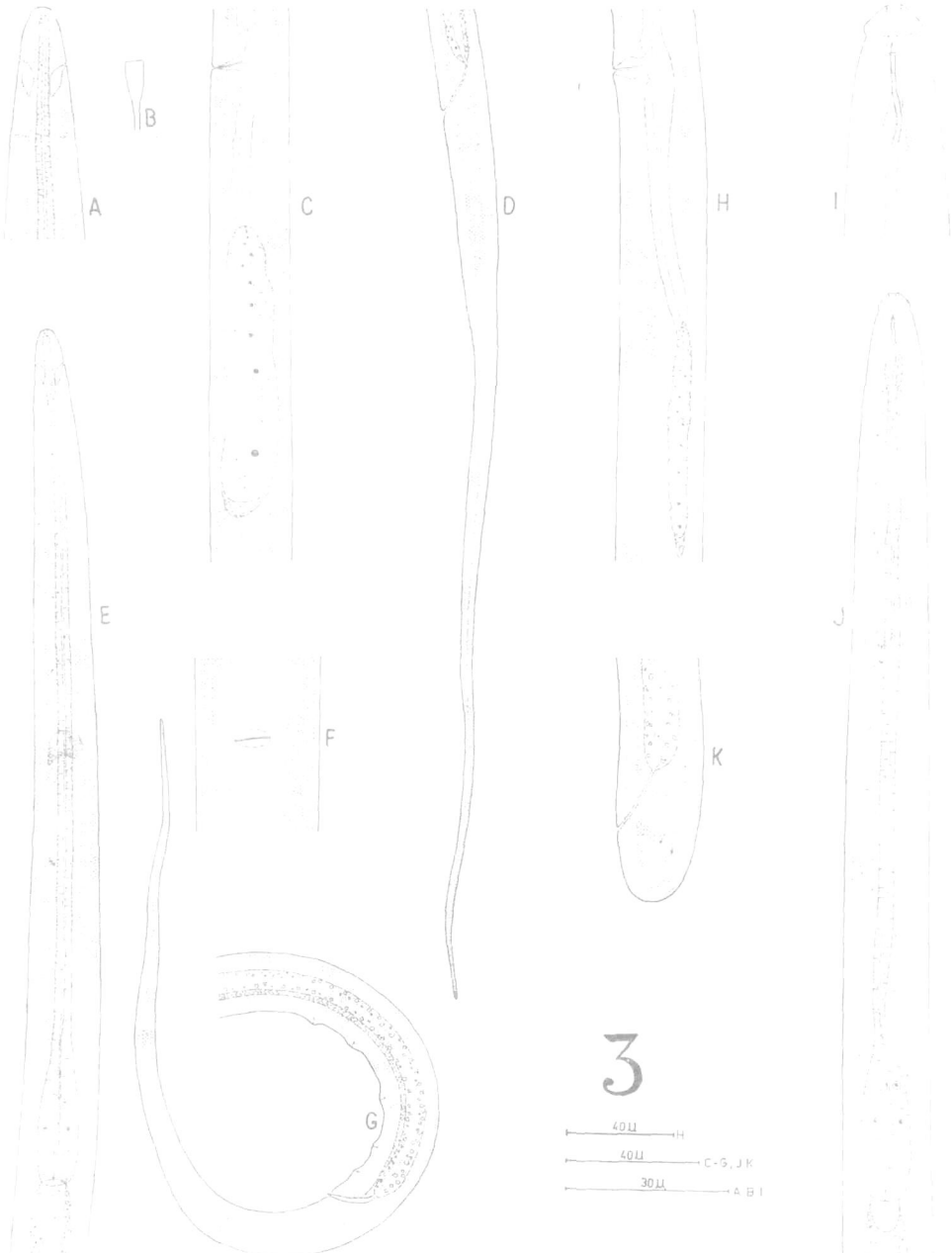

Fig. 3. A-G.—*Amphidelus novus* n.sp. A.—Head end, female. B.—Amphid. C.—Posterior female sexual branch. D.—Tail, female. E.—Oseophageal region, female. F.—Vulva, dorsoventral. G.—Tail, male. H–K.—*Leptonchus capitatus* n.sp. H.—Reproductive organs. I.—Head end. J.—Oesophageal region. K.—Tail end.

Vulva a transverse slit, not bordered by fringed membranes. Vagina 9–13 μ or one-half to one-fourth across the body. Gonads amphidelphic. Combined length of oviduct and uterus 155–192 μ and 149–172 μ of anterior and posterior gonads respectively. Oocytes arranged in a single row except at the tip. Ovaries with single flexure. Sperms not seen in uteri. Prerectum 155–204 μ, 12–15% of total body length or six to eight anal body widths long. Rectum 19–24 μ, about one anal body width long. Tail 21–30 μ hemispheroid, about one anal body width long. Two minute caudal pores present.

Male : Not found.

Habitat : Soil around roots of cotton, *Gossypium hirsutum* from Lalu Kheri, District Muzaffnagar (U.P.), India.

Type Specimens : Collected by Qaiser H. Baqri in October, 1966 ; holotype mounted on slide MSJ/*Leptonchus capitatus*/1 ; 7 paratypes on slide MSJ/*Leptonchus capitatus*/2 ; deposited in the Zoology Museum of Aligarh Muslim University.

Differential Diagnosis : *Leptonchus capitatus* n.sp., comes close to *L. obtusus* Thorne, 1939 but differs in having a shorter body, wider amphids, longer basal bulb and differently shaped tail.

Summary

Six new nematode species of Dorylaimida are described from soil around roots of cotton plant in Uttar Pradesh, India : *Discolaimium mazhari*, *D. upum*, *Aporcelaimellus heynsi*, *A. indicus*, *Leptonchus capitatus* and *Amphidelus novus*. Keys to the species of the genera *Discolaimium* Thorne, 1939 and *Aporcelaimellus* Heyns, 1965 have also been provided.

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TYLENCHORHYNCHUS HEXINCISUS N. SP. AND *TELOTYLENCHUS HISTORICUS* N. SP. (TYLENCHIDA) FROM INDIA

BY

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Tylenchorhynchus hexincisus n. sp., 0.80-1.08 mm long, has 6 incisures in the lateral fields, 16 longitudinal striae, 6 striae in the lip region and tail terminus annulated. *Telotylenchus historicus* n. sp., 0.91-1.17 mm long, has 4 incisures in the lateral fields with occasional areolations, lip region flat at apex and with 8 striae and tail irregularly indented.

TYLENCHORHYNCHUS HEXINCISUS N. SP.

(Fig. 1)

Dimensions

Citrus population (*Type population*): Females (4): L = 0.85-1.08 mm; a = 32-39; b = 6.0-8.2; c = 18-23; V = 52-55.

Holotype (female): L = 1.01 mm; a = 31; b = 7.5; c = 17; V = 53.

Males (6): L = 0.80-1.08 mm; a = 32-43; b = 6.0-7.4; c = 13-20; T = 37-46.

Sunnhemp population: Females (1): L = 0.99 mm; a = 37; b = 7.7; c = 23; V = 52.

Male (1): L = 0.89 mm; a = 43; b = 7.0; c = 17; T = ?

Description

Body ventrally arcuate when relaxed and tapering gradually towards extremities. Cuticle marked with transverse as well as longitudinal striations. Transverse striae about 1 μ apart near middle of body, wider near head end and less wide on tail. Longitudinal striae 3 μ apart, numbering 16 near middle of body, 10-12 in esophageal and tail regions. Lateral fields arise as 2 incisures at level of middle of spear, become 3 near median esophageal bulb, 4 near nerve ring and 6 slightly behind the base of esophagus. They continue with 6 incisures until slightly behind the phasmids where they become 5, then 4 immediately afterwards and finally terminate with 3 incisures. Width of lateral fields averaging 1/5th of the corresponding body width.

Head definitely set off, flat at apex and marked with 6 minute but distinct striae. Head framework present, but not obviously sclerotized. Spear 17-19 μ, delicate, anterior part (metenchium) 10-12 μ or 60-62% of spear length. Base of spear with three distinct, posteriorly sloping knobs, 3-4 μ wide. Esophagus

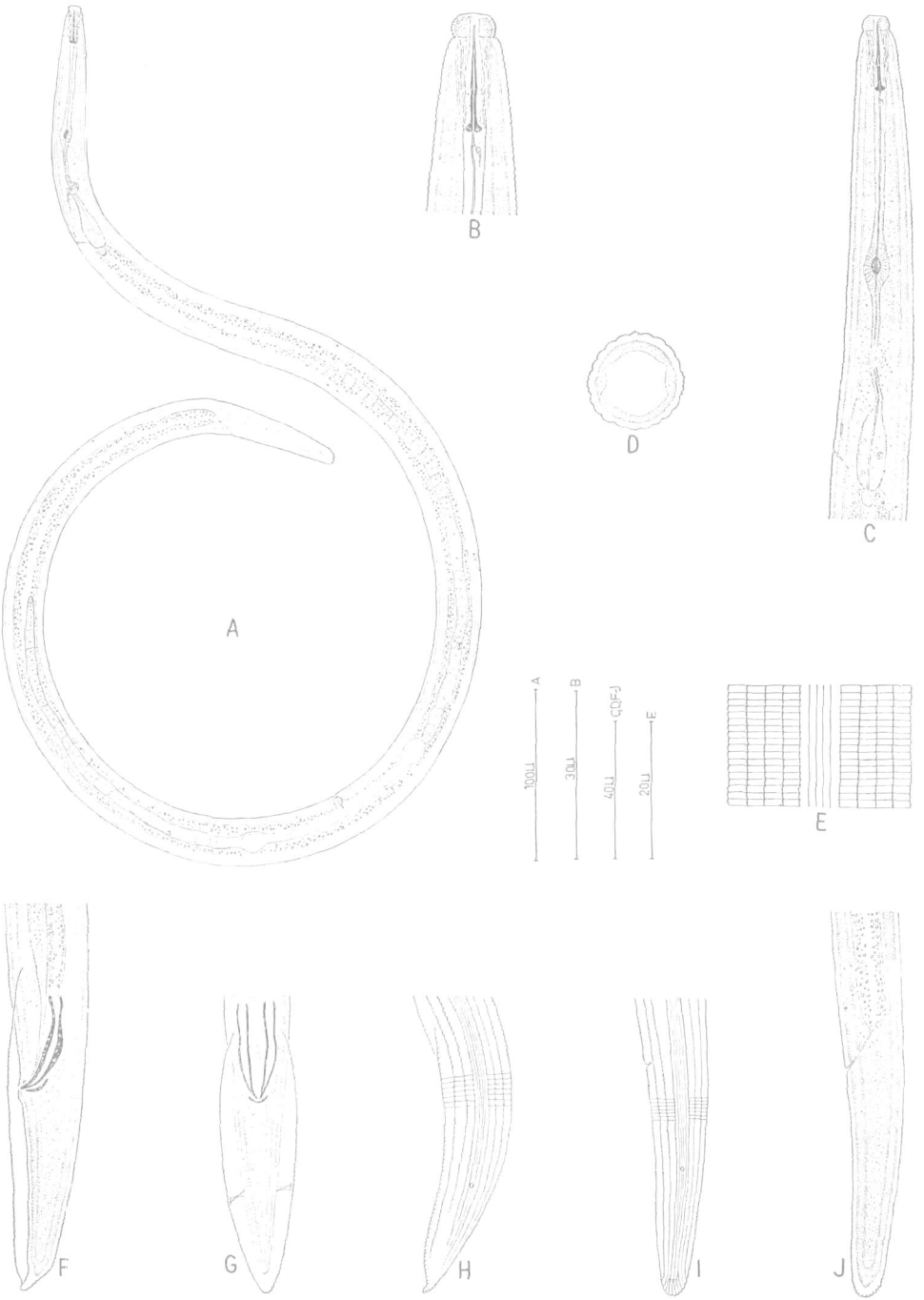

Fig. 1. — *Tylenchorhynchus hexincisus* n. sp. A — Entire female; B — Head end; C — Esophageal region; D — Cross section through middle of body; E — Lateral fields and longitudinal striae near midbody; F — Male tail, lateral; G — Male tail, dorsoventral; H — Male tail, surface view; I — Female tail, surface view; J — Female tail, lateral.

typical. Orifice of dorsal esophageal gland 3-4 μ from base of spear. Nerve ring along middle or slightly behind middle of isthmus. Excretory pore near middle or posterior to middle of basal esophageal bulb. Hemizonid 3-4 striae long, situated 3-8 striae above the excretory pore. Deirids not seen. Cardia rounded.

Female reproductive organs typical. Spermatheca small, spherical, without sperms. Tail subcylindrical, 3-4 anal body widths long, tapering towards tip which is distinctly annulated. Phasmids near middle of tail.

Male reproductive organs typical. Spicules slightly arcuate, 28-31 μ medially. Gubernaculum 8-9 μ, trough-shaped laterally. Bursa moderately developed, with crenate margins. Cloacal opening with protruding lips. Phasmids near middle of tail.

Habitat: Soil around roots of citrus plants (unidentified) from Veraval, Gujrat, India (Type population).

A single male and female specimen from soil around roots of Sunnhemp, *Crotalaria juncea* L., from Veraval, Gujrat, India.

Type specimens: Collected by Mr. Hafeezullah in Nov. 1964; fixed in 4% formalin and mounted in glycerine; holotype female and one paratype male on slide MSJ/*Tylenchorhynchus hexincisus*-1; 5 male and 4 female paratypes on slide MSJ/*Tylenchorhynchus hexincisus*-2; deposited in the Zoology Museum of Aligarh Muslim University, Aligarh, U.P., India.

Sunnhemp population: Collected, fixed, mounted and deposited as above. Specimens on slide MSJ/*Tylenchorhynchus hexincisus*-3.

Differential diagnosis: *Tylenchorhynchus hexincisus* n. sp., in having 6 incisures in the lateral fields, cuticle with longitudinal striae and tail terminus annulated comes closest to *T. tessellatus* J. B. Goodey, 1952 but differs from it in having the following characters: lateral fields narrow (1/3rd body width in *T. tessellatus*) and their pattern is different on tail; only 16 longitudinal striae which continue well up to the posterior extremity (longitudinal striae 48 near middle of body in *T. tessellatus* and fade away in the posterior half of body); nerve ring in the middle or posterior to middle of isthmus (close to median esophageal bulb in *T. tessellatus*); smaller and differently shaped spicules (spicules 34 μ and wider towards proximal end in *T. tessellatus*) and smaller gubernaculum (11-12 μ in *T. tessellatus*).

TELOTYLENCHUS HISTORICUS N. SP.

(Fig. 2)

Dimensions

Females (19): L = 1.06 (0.91-1.17 mm); a = 44 (40-49); b′ * = 5.7 (5.3-6.5); c = 29 (25-35); V = 55 (50-63).

Holotype (female): L = 1.06 mm; a = 42; b = 5.8; c = 33; V = 56.

* b′ = total length of body divided by length of esophagus to end of esophageal glands.

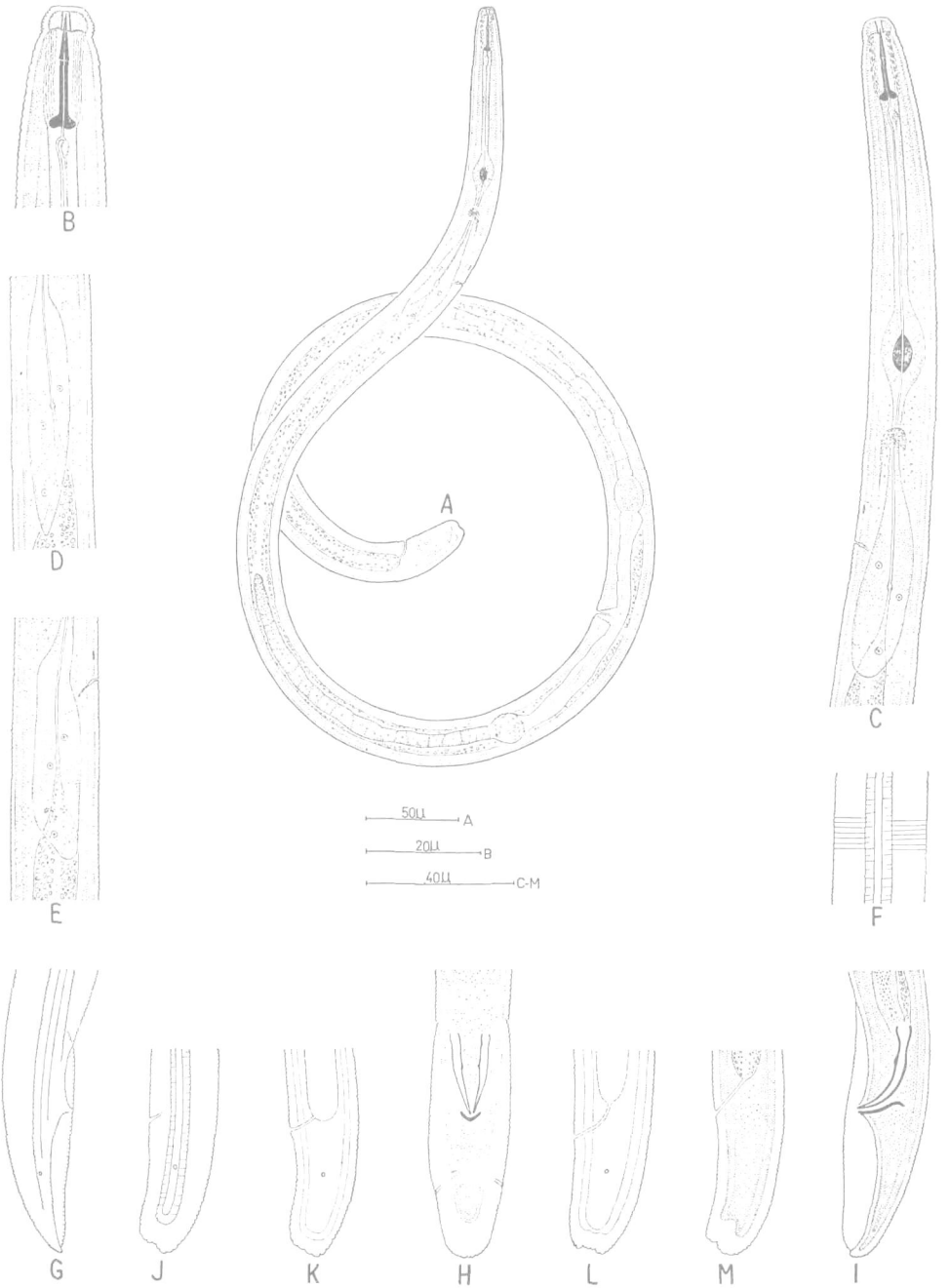

Fig. 2. — *Telotylenchus historicus* n. sp. A — Entire female; B — Head end; C — Esophageal region; D & E — Esophageal gland lobe; F — Lateral field near midbody; G — Male tail, surface view; H — Male tail, dorsoventral; I — Male tail, lateral; J — Female tail, surface view, K-M — Female tail, lateral.

Males (11): L = 1.01 (0.91-1.08 mm); a = 42 (40-45); b = 5.5 (5.0-6.2); c = 25 (22-29); T = 39 (33-42).

Description

Body straight, irregularly curved or 'C' shaped when relaxed and tapering slightly towards extremities. Cuticle marked with transverse striae about 1-2 μ apart. Lateral fields arise with 2 incisures near middle of spear, become 3 near dorsal esophageal gland opening and 4 near median esophageal bulb and continue with 4 incisures slightly above the tail terminus. Width of lateral fields 1/3rd-1/4th of the corresponding body. Lateral fields irregularly areolated throughout the entire length, areolations more distinct on female tail but could not be detected on male tail.

Head set off, flat at apex and marked with 8 minute but distinct striae. Head framework faintly sclerotized. Spear 19-21 μ, stout, anterior part (metenchium) 7-9 μ or 38-45% of spear length. Base of spear with three distinct rounded, posteriorly sloping knobs, 4-5 μ wide. Esophagus typical. Valvular apparatus of the median esophageal bulb very large and distinct. The three esophageal glands form a compact lobe with conoid to rounded terminus, overlapping the intestine for about 1½ times the body width at junction with the intestine. Orifice of dorsal esophageal gland 2-3 μ from base of spear. Nerve ring around middle of isthmus. Excretory pore near middle or anterior to middle of the esophageal gland lobe. Hemizonid 2-4 annules long, situated 3-7 striae above the excretory pore. Deirids at level of excretory pore.

Female reproductive organs typical. Spermatheca large, spherical, with sperms. Tail cylindrical with irregularly indented terminus (very rarely with flat terminus), 1½ to over 2 anal body widths long. Phasmids near middle of tail.

Male reproductive organs typical. Spicules slightly arcuate, 24-25 μ long medially. Gubernaculum 10-12 μ long, proximal end bent posteriad. Bursa well developed, with crenate margins. Anus with protruding lips. Phasmids near middle of tail.

Habitat: Soil around roots of Patsan, *Hibiscus cannabinus* L., near to the Ajanta caves, Maharashtra, India.

Type specimens: Collected by M. S. Jairajpuri in Aug. 1966; fixed in 4% formalin and mounted in glycerine; holotype female and one paratype male on slide MSJ/*Telotylenchus historicus*-1; 10 male and 19 female paratypes on slides MSJ/*Telotylenchus historicus*-2-6; deposited in the Zoology Museum of Aligarh Muslim University, Aligarh.

Differential diagnosis: *Telotylenchus historicus* n. sp., comes closest to *T. housei* Raski, Prasad & Swarup, 1964 but differs in character of lateral fields, length of spear and shapes of lip region and tail terminus.

One of us (Q.H.B.) gratefully acknowledges the financial assistance by the Indian Council of Agricultural Research, New Delhi.

ZUSAMMENFASSUNG

Tylenchorhynchus hexincisus *n. sp. und* Telotylenchus historicus *n. sp.* (*Tylenchida*) *aus Indien*

Tylenchorhynchus hexincisus n. sp. ist 0,80-1,08 mm lang und besitzt 6 Einschnitte in den Seitenfeldern, 16 Längsstreifen, 6 Streifen auf der Lippenregion und ein geringeltes Schwanzende.

Telotylenchus historicus n. sp. ist 0,91-1,17 mm lang und besitzt 4 Einschnitte in den Seitenfeldern mit gelegentlichen Areolationen, eine vorn flache Lippenregion mit 8 Streifen und einen unregelmäßig eingeschnittenen Schwanz.

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STUDIES ON BELONDIROIDEA (NEMATODA) FROM INDIA

BY

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Two new species of *Dorylaimellus* Cobb, 1913 are described from India. *Dorylaimellus jacobi* n. sp., 0.89-0.98 mm long, has 70-85 glandular organs, thin spear, single ovary and a cylindrical bluntly rounded tail, 2 anal body widths long. *Dorylaimellus clavatus* n. sp., 0.40-0.48 mm long, has 32-40 glandular organs, a labial disc, 4-5 μ long spear, two ovaries and an almost clavate tail, 1½ anal body widths long. Some additional data are given for *Dorylaimellus longicaudatus* Jairajpuri, 1964; *D. discocephalus* Siddiqi, 1964; *D. indicus* Siddiqi, 1964; *D. directus* Heyns, 1963 and *D. vexator* Heyns, 1963. *Belondira paraclava* Jairajpuri, 1964 and *Oxydirus gigas* Jairajpuri, 1964 are considered valid species and *Oxydirus oxycephalus* (de Man, 1885) Thorne, 1939 is reported for the first time from India.

Large numbers of specimens of Belondiroidea Thorne, 1964 were obtained from time to time in the survey of nematodes associated with fibrous crop in India. They represent in all two new and five known species of *Dorylaimellus* Cobb, 1913; two species of *Oxydirus* Thorne, 1939 and one species of *Belondira* Thorne, 1939.

All the specimens used in this study were fixed in hot 4% formalin and mounted in glycerine by the slow method. The type material is deposited with the Zoology Museum of Aligarh Muslim University, Aligarh, U.P., India.

DORYLAIMELLUS JACOBI N. SP.

(Fig. 1)

Dimensions:

Mehalwala population (Type): Females (7): L = 0.95 mm (0.89-0.98 mm); a = 39 (36-42); b = 6.4 (6.0-7.0); c = 33 (32-35); V = $^{15}58^{3}$ ($^{12\cdot18}54\text{-}61^{3}$).

Female (holotype): L = 0.96 mm; a = 40; b = 6.3; c = 34; V = $^{16}56^{3}$.

Male (1): L = 0.80 mm; a = 42; b = 5.1; c = 32; T = 51.

Chaprolla population: Female (1) L = 0.94 mm; a = 36; b = 5.4; c = 29; V = $^{12}55^{2}$.

Deoband population: Females (2): L = 0.94-1.01 mm; a = 39-40; b = 5.6-6.0; c = 31; V = $^{18\cdot23}55\text{-}58^{3}$.

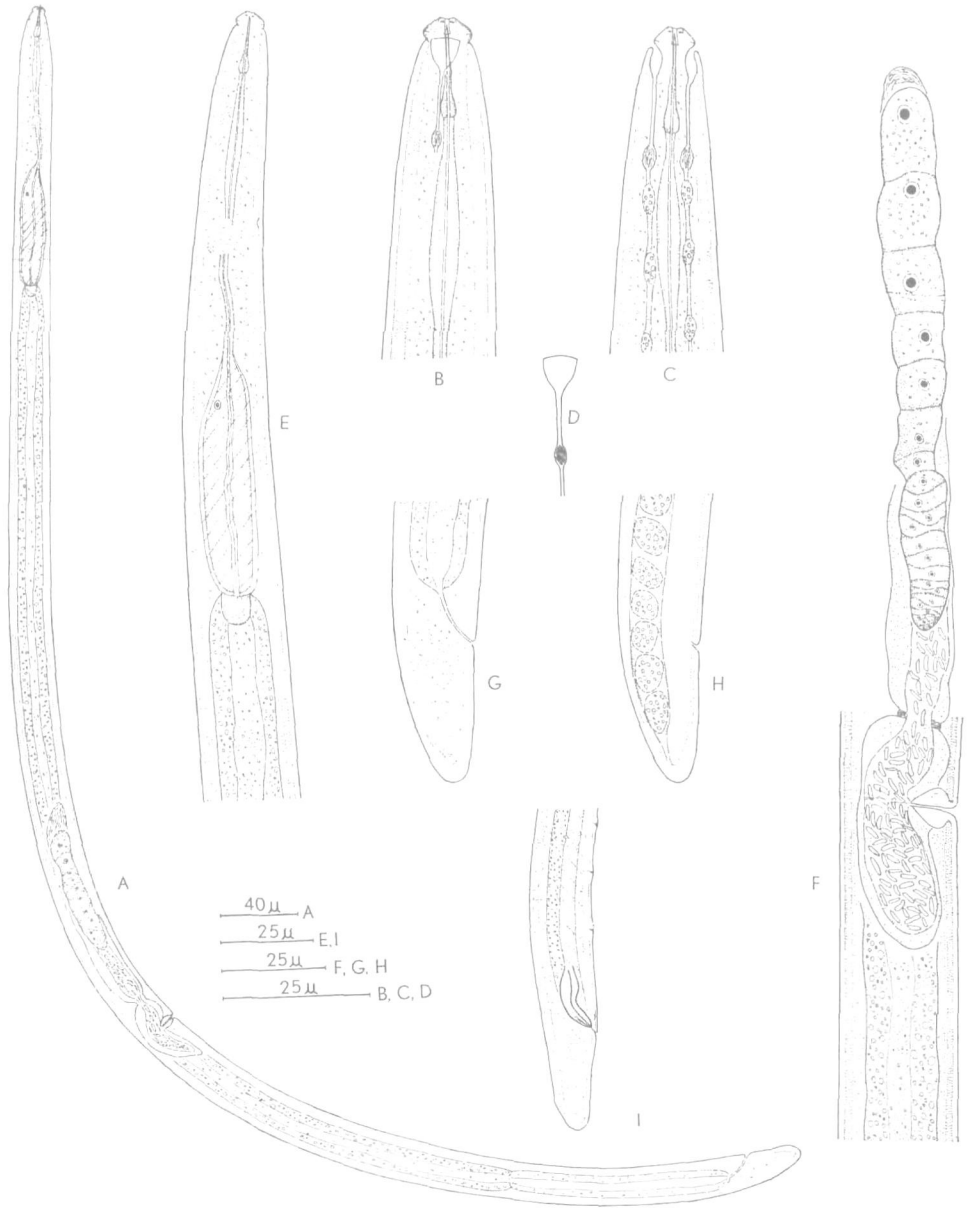

Fig. 1. *Dorylaimellus jacobi* n. sp. A - Entire female; B - Head end, lateral; C - Head end, dorso-ventral; D - Amphid; E - Esophageal region; F - Female gonad; G & H - Female tails; I - Male tail.

Description:

Female: Body tapering gradually anterior to slender part of esophagus and upon death lies irregularly curved. Outer cuticle 3 μ at tail, marked with faint transverse striations. Inner cuticle also faintly striated. Lateral hypodermal chords 1/4th to 1/3rd of body width near middle. Lateral glandular organs conspicuous, 70-85 in number of which 7-9 in esophageal region, variable in size and irregular in arrangement. Head offset, about as wide as adjoining body and nearly 1/3rd of body width at base of esophagus. Amphidial apertures about 3 μ from anterior end, occupy 4-5 μ or more than 1/2 of the corresponding body width. Sensillar pouches 15-16 μ from amphidial slits.

Spear thin, 4-5 μ long, its aperture about 1 μ. Spear extensions 9-10 μ long. Basal expanded portion of esophagus occupies 35-41% of total esophageal length, its width 1/3rd to 1/2 of body width at base of esophagus and 1/8th to 1/6th of its own length. Opening of dorsal esophageal gland 90-99 μ or 60-67% of esophageal length from anterior end. Nerve ring 54-60 μ from anterior end. Cardia rounded.

Vulva longitudinal. Vagina 9-12 μ long, extending about 1/3rd to 1/2 across the body. Gonad mono-prodelphic. Posterior uterine sac 25-31 μ or 1 to $1\frac{1}{2}$ body widths long. Oviduct and uterus distinctly separated by sphincter, their combined length 112-178 μ. Uterus and posterior uterine sac filled with sperms. Prerectum 115 to 143 μ or 7 to 9 anal body widths long. Tail cylindrical with bluntly rounded terminus, about 2 anal body widths long.

Male: Supplements an adanal pair and 3 ventromedians, the latter beginning about 2 anal body widths in front of the anus, spaced nearly at regular intervals. Spicules 22 μ long medially. Lateral guiding pieces present, faintly visible and difficult to measure. Tail as in female, only slightly irregular in outline.

Habitat: *Mehalwala population* (*Type*): Soil around roots of cotton, *Gossypium herbaceum* L. from Mehalwala, District Meerut, U.P., India.

Chaprolla population: Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Chaprolla, District Bulandsher, U.P., India.

Deoband population: Soil around roots of cotton, *Gossypium herbaceum* from Deoband, District Saharanpur, U.P., India.

Type specimens: Collected in October 1966 by Qaiser H. Baqri; holotype mounted on slide MSJ/*Dorylaimellus jacobi*/1; paratypes on slides MSJ/*Dorylaimellus jacobi*/2-5.

Specimens from Chaprolla and Deoband are mounted on slides MSJ/*Dorylaimellus jacobi*/6-8.

Differential diagnosis: *Dorylaimellus jacobi* n. sp., in having mono-prodelphic gonad comes close to *D. aequalis* (Cobb, 1918) Thorne, 1939 but differs in having narrow amphids, more prominent and larger number of glandular organs, thin spear and smaller spear extensions, smaller posterior uterine sac, longer prerectum, differently shaped tail and spicules.

The species is named after Mr. J. J. s'Jacob, Landbouwhogeschool, Wageningen, The Netherlands.

DORYLAIMELLUS CLAVATUS N. SP.
(Fig. 2)

Dimensions:

Females (9): L = 0.46 mm (0.40-0.48 mm); a = 30 (27-31); b = 2.8 (2.4-3.0); c = 28 (27-30); V = $^{5}59^{5}$ ($^{4\text{-}6}58\text{-}61^{4\text{-}6}$).

Female (holotype): L = 0.48 mm; a = 30; b = 3.0; c = 30; V = $^{5}61^{6}$.

Description:

Female: Body tapering gradually anterior to slender part of esophagus and upon death lies straight or slightly curved in posterior third of its length. Outer cuticle 3-5 μ at tail, marked with faint transverse striations. Inner cuticle also faintly striated. Lateral hypodermal chords 1/4th to 1/3rd of body width near middle. Lateral glandular organs conspicuous, 32-40 in number of which 10-12 in esophageal region, variable in size and irregular in arrangement. Head set off, wider than adjoining body and about 1/3rd of body width at base of esophagus. Inner labial papillae forming a disc-like structure. Amphidial apertures about 3 μ from anterior end and occupy 3-4 μ or more than 1/2 of corresponding body width. Sensillar pouches 8-9 μ from amphidial slits.

Spear 4-5 μ long, its aperture about 1 μ. Guiding ring about 4 μ from anterior end. Spear extensions 9-10 μ long. Basal expanded portion of esophagus occupies 50-55% of total esophageal length, its width nearly 1/2 of body width at base of esophagus and 1/16th to 1/13th of its own length. Opening of dorsal esophageal gland 91-98 μ or 54-57% of the esophageal length from anterior end. Nerve ring 48-55 μ from anterior end. Cardia rounded.

Vulva longitudinal. Vagina 5-6 μ, extending about 1/3rd across the body. Gonads amphidelphic. Combined length of oviduct and uterus 19-28 μ of anterior gonad and 20-26 μ of posterior gonad. No sperms in uteri. Prerectum 34-47 μ or 3-4 anal body widths long. Rectum 9-12 μ, about one anal body width long. Tail almost rounded with clavate terminus, about 1½ anal body widths long.

Male: Not found.

Habitat: Soil around roots of cotton, *Gossypium arboreum* L., from Mundia Khurd, District Rampur, U.P., India.

Type specimens: Collected in November, 1966 by Qaiser H. Baqri; holotype mounted on slide MSJ/*Dorylaimellus clavatus*/1; paratypes on slides MSJ/*Dorylaimellus clavatus*/2-4.

Differential diagnosis: *Dorylaimellus clavatus* n. sp., comes close to *D. parvulus* Thorne, 1939 and *D. yangambiensis* Geraert, 1962. From the former it differs in having much wider lateral chords, larger number of glandular organs,

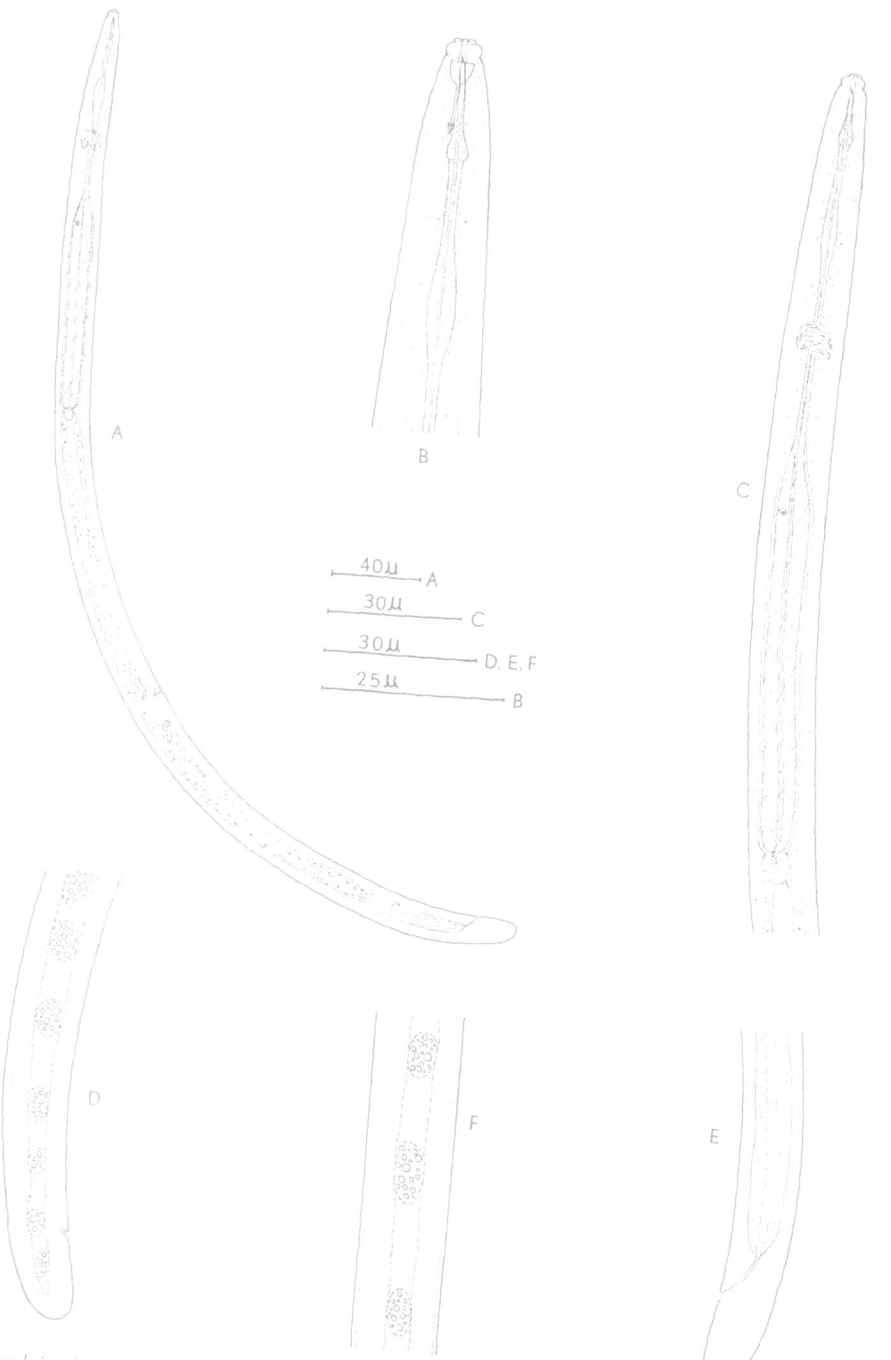

Fig. 2. *Dorylaimellus clavatus* n. sp. A - Entire female; B - Head end, lateral; C - Esophageal region, D & E - Female tails; F - Lateral hypodermal chords near middle of body.

differently shaped lip region, longer spear extensions and shorter prerectum. From *D. yangambiensis* it differs in having narrower amphids, rounded lip region with a labial disc, shorter spear and spear extensions and differently shaped tail.

DORYLAIMELLUS LONGICAUDATUS JAIRAJPURI, 1964

Dimensions:

Females (4): L = 0.82-0.96 mm; a = 38-46; b = 4.5-5.0; c = 18-20; V = 4.6^{45}-48$^{6.7}$.

Description: (The original description of this species by Jairajpuri (1964) is based on a single specimen, it is amplified in the following).

Female: Body tapering towards both extremities. Lateral hypodermal chords 1/5th to 1/4th of body width near middle. Lateral glandular organs conspicuous, 45-52 in number, 9-11 in esophageal region, variable in size, squarish in shape and irregular in arrangement. Head offset, about 1/3rd of body width at base of esophagus. Inner cephalic papillae form a very small disc-like structure.

Spear 6-7 μ long, about the width of lip region; its aperture 2 μ. Spear extensions 12-13 μ long. Basal expanded portion of esophagus occupies 46-52% of total esophageal length. Cardia hemispheroid.

Vulva longitudinal. Gonads amphidelphic. Prerectum 104- 134 μ or 10-12 anal body widths long. Rectum 9-13 μ, about equal to one anal body width long. Tail long, cylindrical, with rounded terminus, 4-5 times the anal body width.

Male: Not found.

Habitat: Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Barwe Sagar, District Jhansi, U.P., India.

DORYLAIMELLUS DISCOCEPHALUS SIDDIQI, 1964
(Fig. 3, A-C)

Dimensions: See Table I.

TABLE I
Dimensions of Dorylaimellus discocephalus

Populations	n	L (in mm)	a	b	c	V
Mehalwala	5 ♀♀	0.91-1.06	42-48	3.7-4.4	33-42	5.7^{50}-55$^{5.7}$
Deoband	4 ♀♀	0.98-1.03	40-47	3.8-5.6	34-37	5.7^{50}-51$^{5.8}$
Modipur	5 ♀♀	1.07-1.21	42-45	4.3-5.1	38-41	7.8^{51}-53$^{6.7}$
Ahmadpur Brahman	4 ♀♀	1.01-1.07	41-46	4.4-5.0	34-40	6.7^{50}-53$^{6.7}$
Badalpur	4 ♀♀	1.03-1.25	41-46	4.9-5.4	34-44	5.8^{50}-53$^{6.7}$
Chaprolla	2 ♀♀	0.96-1.11	52-62	4.0-5.0	34-37	6.7^{51}-54$^{6.8}$
Kaurpur	5 ♀♀	1.02-1.21	39-44	4.8-5.2	34-42	5.7^{49}-51$^{6.7}$
Shamli	5 ♀♀	1.02-1.10	45-49	3.6-5.2	32-36	6.7^{49}-52$^{5.7}$
Kureda	5 ♀♀	1.01-1.21	43-51	4.0-5.1	34-40	6.7^{50}-51$^{6.7}$

Description: (Based on a large number of specimens from different populations).

Body tapering gradually anterior to slender part of esophagus, upon death lies curved in posterior third of its length. Lateral hypodermal chords 1/4th to 1/3rd of body width near middle. Lateral glandular organs conspicuous, 61-75 in number, variable in size and irregular in arrangement. Head well offset, about one-third of body width at base of esophagus. Amphidial aperture occupies 4-5 μ, about 3/4th of the corresponding body width. Sensillar pouches 13-15 μ from amphidial slits.

Spear 5-6 μ long, its aperture about 1/4th of its length. Spear extensions 10-12 μ long. Basal expanded portion of esophagus occupies 48-54% of total esophageal length.

Vulva longitudinal. Vagina 10-12 μ or less than one half of the corresponding body width. Gonads amphidelphic and reflexed. Prerectum 52-74 μ, about 3-4 anal body widths long. Rectum about equal to one anal body width long. Tail elongate, cylindrical with bluntly rounded terminus, 2-2½ anal body widths long.

Habitats: Soil around roots of Cotton, *Gossypium* sp. from the following localities of U.P., India: 1) Mehalwala, Meerut; 2) Deoband, Saharanpur; 3) Modipur, Saharanpur; 4) Ahmadpur Brahman, Saharanpur; 5) Badalpur, Bulandsher; 6) Chaprolla, Bulandsher; 7) Kaurpur, Mainpuri; 8) Shamli, Muzzafarnagar and 9) Kureda, Muzzafarnagar.

DORYLAIMELLUS INDICUS SIDDIQI, 1964
(Fig. 3, D-F)

Dimensions: See Table II.

TABLE II
Dimensions of Dorylaimellus indicus

Populations	n	L (in mm)	a	b	c	V
Kailashpur	5 ♀♀	1.00-1.31	45-53	6.7-7.6	37-42	$5^{7}50\text{-}52^{6\text{-}8}$
Modipur	4 ♀♀	1.37-1.66	44-49	7.9-9.0	34-44	$6^{7}49\text{-}51^{5\text{-}7}$
Badalpur	4 ♀♀	1.48-1.62	46-50	8.3-9.0	35-46	$6^{7}49\text{-}51^{6\text{-}8}$
Chaprolla	5 ♀♀	1.32-1.54	41-45	7.8-8.9	39-46	$6^{7}50\text{-}52^{6\text{-}7}$
Ajitganj	3 ♀♀	1.01-1.13	43-47	6.8-7.2	38-40	$5^{6}50\text{-}51^{6\text{-}7}$
Banrti Khaira	5 ♀♀	1.28-1.52	44-53	7.3-8.1	40-46	$5^{7}48\text{-}51^{6\text{-}7}$
Malpura	5 ♀♀	1.38-1.68	41-47	8.3-9.0	39-48	$6^{7}48\text{-}55^{6\text{-}8}$
Kaishupur	3 ♀♀	1.26-1.44	47-53	8.0-9.3	42-44	$6^{8}51\text{-}53^{6\text{-}9}$

Description: (Based on a large number of specimens from different populations).

Body tapering gradually anterior to slender part of esophagus and upon death lies curved in the posterior half, often 'C' shaped. Lateral hypodermal chords about

one-third of body width near middle. Lateral glandular organs conspicuous 90-112 in number, variable in size and irregular in arrangement. Head offset by a deep constriction, about one-third of body width at base of esophagus. Amphidial apertures occupy about 2/3rds of corresponding body width. Sensillar pouches 16-19 μ from amphidial slits.

Spear 6-7 μ long, its aperture about 1/3rd of spear length. Spear extensions 11-12 μ long. Basal expanded portion of esophagus occupies 38-42% of total esophageal length.

Vulva longitudinal. Vagina 12-14 μ, extending about 1/3rd to 1/2 of the corresponding body width. Gonads amphidelphic and reflexed. Prerectum 37-66 μ, about 2-4 anal body widths long. Rectum 12-15 μ long, less than one anal body width long. Tail cylindrical, elongated with bluntly rounded terminus, about 1½ to 2 anal body widths long.

Habitats: Soil around roots of Cotton, *Gossypium* sp., from the following localities of U.P., India: 1) Kailashpur, Saharanpur; 2) Modipur, Saharanpur; 3) Badalpur, Bulandsher; 4) Chaprolla, Bulandsher; 5) Ajitganj, Mainpuri; 6) Banrti Khaira, Muzzafarnagar; 7) Malpura, Agra and 8) Kaishupur, Etawah.

DORYLAIMELLUS DIRECTUS HEYNS, 1963

Dimensions:

Pahasu population: Females (2): L = 0.71-0.74 mm; a = 26-35; b = 3.2-3.4; c = 23-25; V = $^{5\text{-}6}50\text{-}53^{6\text{-}7}$.

Deoband population: Females (2): L = 0.76-0.86 mm; a = 35-40; b = 2.9-3.7; c = 23-27; V = $^{5\text{-}6}50\text{-}56^{6\text{-}7}$.

Habitats: Soil around roots of Cotton plants, *Gossypium* sp. from Pahasu, district Bulandsher and Deoband, district Saharanpur, U.P., India.

DORYLAIMELLUS VEXATOR HEYNS, 1963

Dimensions:

Females (6): L = 1.00-1.20 mm; a = 36-40; b = 4.0-4.3; c = 32-37; V = $^{6\text{-}7}48\text{-}49^{7\text{-}8}$.

Habitat: Soil around roots of Patson, *Hibiscus cannabinus* L. from Ajanta, Maharashtra.

BELONDIRA PARACLAVA JAIRAJPURI, 1964

Siddiqi (1966) listed this species as a synonym of *B. caudata* Thorne, 1939 without mentioning reasons for his action. A study of the type material and some fresh specimens collected from the type locality clearly shows that *B. paraclava* is distinctly different from *B. caudata* in the shape of tail which has its outer cuticle greatly swollen to give it a clavate appearance. *Belondira paraclava* is therefore regarded as a valid species and not a synonym of *B. caudata* as was proposed by Siddiqi.

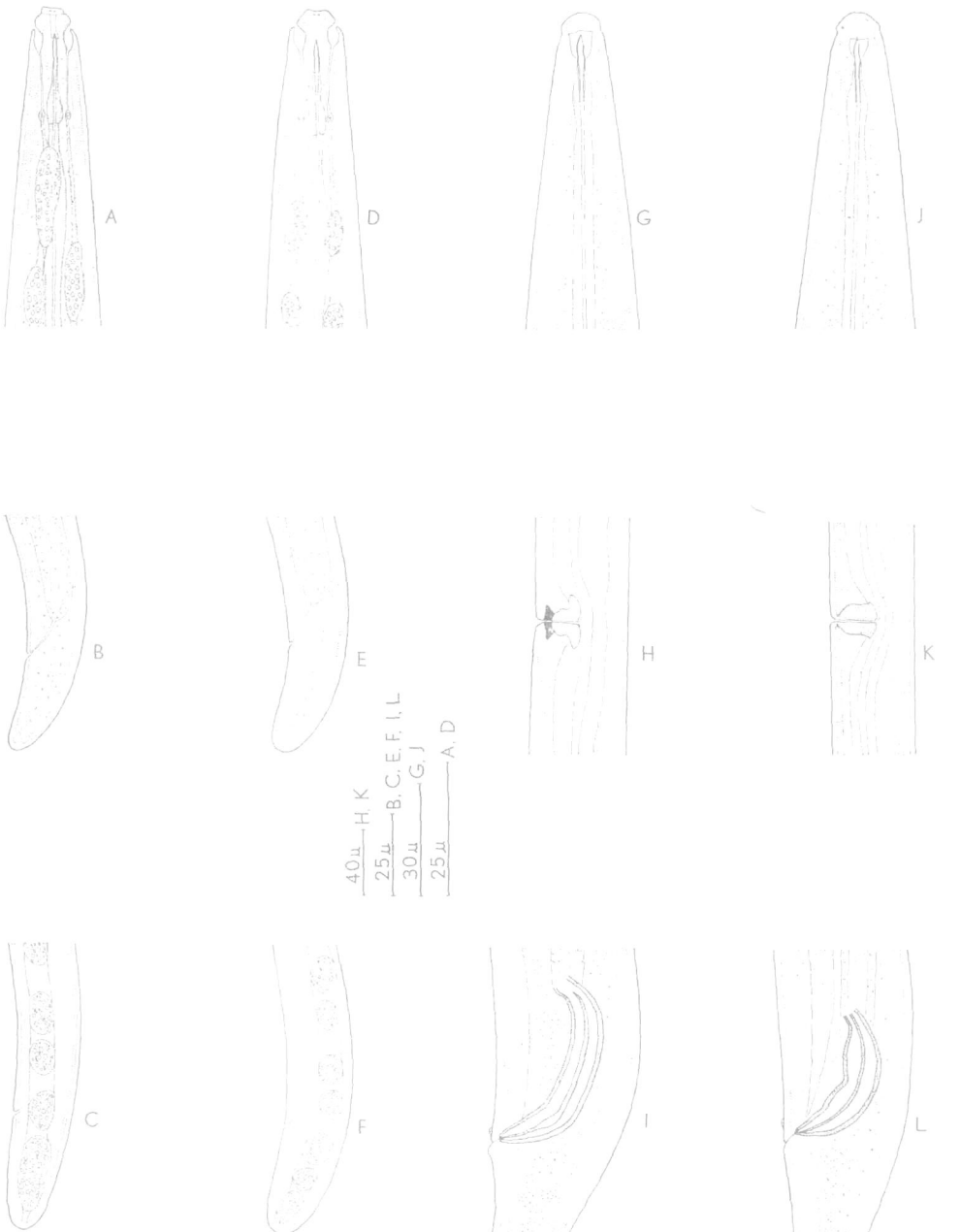

Fig. 3. A-C *Dorylaimellus discocephalus* A - Head end, dorsoventral; B & C Female tail; D-F *Dorylaimellus indicus* D - Head end, dorsoventral; E & F - Female tail; G-I *Oxydirus magnus* G - Head end, lateral; H - Vulva region; I - Spicular region; J-L *Oxydirus gigas* J - Head end, lateral; K - Vulva region; L - Spicular region.

OXYDIRUS OXYCEPHALUS (DE MAN, 1885) THORNE, 1939

Dimensions:

Females (15): L = 1.2-1.3 mm; a = 42-45; b = 4.7-5.5; c = 7-10; V = 35-41.

Habitat: Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Kashmir, India.

OXYDIRUS GIGAS * JAIRAJPURI, 1964
Syn. *O. magnus* apud Siddiqi, 1966
(Fig. 3, J-L)

Siddiqi (1966) doubtfully synonymized this species with *O. magnus* Timm, 1964. Incidentally the description of both *O. magnus* and *O. gigas* appeared in the same issue of the journal, the former having page priority. However, comparison of the type specimens of both these species and some fresh specimens of *O. gigas* recently collected from Jogipura, District Bijnore, U.P., India clearly revealed that the two species are distinctly different in a number of characters. The dimensions of the two species and their differential characters are as follows. The male specimen of *Oxydirus* identified as *O. magnus* by Siddiqi (1966) belongs to the species *O. gigas*.

Dimensions:

Oxydirus gigas (after Jairajpuri, 1964):

Males (2): L = 3.7-4.3 mm; a = 61-86; b = 12-13; c = 11-12;

Females (2): L = 3.8-4.5 mm; a = 65-66; b = 12-13; c = 10; V = 40-42.

Spear 5-6 μ; spear extension = 8-10 μ; ventromedian supplements = 15; spicules 48-49 μ.

Oxydirus gigas (after Siddiqi, 1966):

Male (1): L = 3.7 mm; a = 88; b = 13; c = 14; T = 53.

Spear 6 μ; spear extension = 11 μ; ventromedian supplements = 15; spicules 49 μ.

Oxydirus gigas (Jogipura population):

Female (1): L = 3.89 mm; a = 70; b = 12.8; c = 9; V = 39.

Males (2): L = 3.62-3.72 mm; a = 84-86; b = 12.0-12.2; c = 10-15.

Spear = 5-7 μ; spear extension = 8-10 μ; ventromedian supplements = 13; spicules 48-51 μ.

Habitat: Soil around roots of Sunn hemp, *Crotalaria juncea* L.; from Jogipura, District Bijnore, U.P., India.

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* *gigus* emended.

Oxydirus magnus (after Timm, 1964) (Fig. 3, G-I):

Females (6): L = 4.85-5.72 mm; a = 85-117; b = 13.2-17.1; c = 12-15; V = 33-40.

Males (6): L = 4.43-4.94 mm; a = 87-103; b = 14.0-15.4; c = 17-21.

Spear = 9 μ; spear extension = 10 μ; ventromedian supplements = 12-16; spicules 54-57 μ.

Differential diagnosis: Besides the differences in various body dimensions *O. gigas* differs from *O. magnus* in the shape of lip region and amphids, in having smaller and differently shaped spear, vagina without cuticularized pieces (vagina with cuticularized pieces in *O. magnus*) and differently shaped spicules.

We are thankful to Father R. W. Timm for kindly sending us the type specimens of *Oxydirus magnus*. One of us (Q.H.B.) gratefully acknowledges the financial assistance provided to him by the Indian Council of Agricultural Research, New Delhi.

ZUSAMMENFASSUNG

Untersuchungen über Belondiroidea (Nematoda) aus Indien

Zwei neue Arten der Gattung *Dorylaimellus* Cobb, 1913 werden aus Indien beschrieben. *Dorylaimellus jacobi* n. sp. 0,89-0,98 mm lang, besitzt 70-85 Drüsenorgane, einen dünnen Mundstachel, ein einzelnes Ovar und einen zylindrischen, stumpf gerundeten Schwanz, der zwei Körperbreiten lang ist. *Dorylaimellus clavatus* n. sp., 0,40-0,48 mm lang, besitzt 32-40 Drüsenorgane, eine Lippenscheibe, einen 4-5 μ langen Mundstachel, zwei Ovarien und einen fast keulenförmigen, 1,5 Körperbreiten langen Schwanz.

Über *Dorylaimellus longicaudatus* Jairajpuri, 1964, *D. discocephalus* Siddiqi, 1964, *D. indicus* Siddiqi, 1964, *D. directus* Heyns, 1963 und *D. vexator* Heyns, 1963 werden ergänzende Mitteilungen gemacht. *Belondira paraclata* Jairajpuri, 1964 und *Oxydirus gigas* Jairajpuri, 1964 werden als gültige Arten angesehen. *Oxydirus oxycephalus* (de Man) Thorne, 1939 wurde zum ersten Mal in Indien gefunden.

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Nematologica 14 (1968): 592. E. J. Brill, Leiden

QAISER H. BAQRI & M. SHAMIM JAIRAJPURI[1]): Dorylaimellus deviatus *nom. nov. (syn.* Dorylaimellus clavatus *Baqri & Jairajpuri, 1968 pre-occupied).*

One of the two new species of *Dorylaimellus* Cobb, 1913 published by the authors (1968) was named *D. clavatus*. Thorne (1964) has also named a new species in the same genus as *D. clavatus*. *D. clavatus* Baqri & Jairajpuri, 1968 therefore becomes a junior homonym of *D. clavatus* Thorne, 1964. It is renamed *D. deviatus* nom. nov.

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Nematologica 15 (1969): 408-424. E. J. Brill, Leiden

MORASIA N. GEN. AND THREE NEW SPECIES OF *DORYLAIMOIDES* THORNE AND SWANGER, 1936 (NEMATODA: DORYLAIMOIDEA) FROM INDIA

BY

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A new genus, *Morasia* is proposed for *Dorylaimoides rhabdotus* (Kreis, 1930) Thorne & Swanger, 1936 and a closely related new species, both of which are similar to *Dorylaimoides* but possess dissimilar tails in the two sexes. *Morasia dimorphicauda* n. gen., n. sp. (1.53-1.91 mm long) has 57-70 glandular organs in lateral hypodermal chords, spear 7-9 μ ventrally and 11-13 μ dorsally, spear extensions 17-20 μ, amphidelphic gonads, tail elongate conoid in female and bluntly rounded in male. *Dorylaimoides constrictus* n. sp. (0.80-0.90 mm long) spear 4-5 μ ventrally and 6-7 μ dorsally, spear extensions 9-11 μ, mono-opisthodelphic gonad, tail filiform and 6-9 anal body-widths long. *Dorylaimoides saueri* n. sp. (0.80-0.95 mm long) has spear 7 μ ventrally and 9-10 μ dorsally, spear extensions 12-13 μ, mono-opisthodelphic gonad and tail elongate, 5-6 anal body-widths long. *Dorylaimoides arcuicaudatus* n. sp. (1.24-1.41 mm long) has spear 7-10 μ ventrally and 10-13 μ dorsally, spear extensions 15-16 μ amphidelphic gonads, tail conoid, ventrally arcuate, 2.0-2.5 anal body widths long. Males of *D. arcuatus* Siddiqi, 1964 and *D. parateres* Siddiqi, 1964 are here reported for the first time. A key to the species of the genus *Dorylaimoides* is provided.

A large number of specimens of *Dorylaimoides* Thorne & Swanger, 1936 and a closely related new genus was obtained during the course of investigations on the nematodes associated with fibrous crops of Uttar Pradesh, India. The *Dorylaimoides* populations represent *D. arcuatus* Siddiqi, 1964; *D. parateres* Siddiqi, 1964 and 3 new species described below.

All the specimens used in this study were fixed in hot 4% formalin and mounted in glycerine by the slow method. The type material is deposited with the Zoology museum of Aligarh Muslim University, Aligarh, U.P., India.

The relative positions of esophageal glands and their orifices in all the six species described below are given in Table I in a similar way as by Loof & Jairajpuri (1968).

MORASIA N. GEN.

Differential diagnosis: Leptonchidae. Same as *Dorylaimoides* except for dissimilar tails of sexes, elongate conoid in female and bluntly rounded in male.

Type species: *Morasia dimorphicauda* n. gen., n. sp.

Other species: *M. rhabdotus* (Kreis, 1930) n. comb.

Syn. *Dorylaimoides rhabdotus* (Kreis, 1930) Thorne & Swanger, 1936.

The new genus is named after Mohammed Rafiq Siddiqi.

TABLE I

Relative positions of esophageal glands and their orifices in the species described

	DO	DN	DO-DN	S_1N	S_1O	S_2N	S_2O
Morasia dimorphicauda	72-78%	74-81%	1.5-3%	84-87%	84-87%	88-92%	87-91%
Dorylaimoides constrictus	78-82%	79-83%	1-1.5%	89-92%	87-90%	94-96%	92-94%
Dorylaimoides saueri	77-81%	79-83%	1.2-2.4%	86-90%	86-90%	91-94%	90-93%
Dorylaimoides arcuicaudatus	72-79%	74-80%	1-1.5%	80-88%	79-88%	86-94%	85-92%
Dorylaimoides arcuatus	75-80%	76-81%	1-1.5%	84-89%	84-88%	89-95%	89-93%
Dorylaimoides parateres	73-74%	75-76%	1.7-2.4%	80-83%	79-83%	90-92%	89-90%

MORASIA DIMORPHICAUDA N. SP.

(Fig. 1)

Dimensions:

Bhognipur population (Type): Females (7): L = 1.53-1.91 mm; a = 35-45; b = 6.2-8.3; c = 23-31; V = $^{9\text{-}13}42\text{-}47^{9\text{-}13}$.

Female (holotype): L = 1.78 mm; a = 39; b = 6.9; c = 28; V = $^{13}45^{14}$.

Males (4): L = 1.60-1.79 mm; a = 41-49; b = 6.5-6.8; c = 45-51; T = 50-55.

Bamanheri population: Females (2): L = 1.70-1.78 mm; a = 42-44; b = 6.9-7.0; c = 28-31; V = $^{10}43\text{-}45^{10\text{-}11}$.

Males (2): L = 1.60-1.79 mm; a = 43-44; b = 6.4-7.2; c = 43-45; T = 56-59.

Deoband population: Females (2): L = 1.67-1.80 mm; a = 35-40; b = 6.8-7.2; c = 21-30; V = $^{12\text{-}17}43\text{-}44^{12\text{-}18}$.

Description:

Female: Body curved in posterior half of its length upon fixation and tapering gradually anterior to slender part of esophagus. Outer and inner cuticle finely striated. Lateral hypodermal chords 1/10th-1/6th (averaging 1/7th) of body-width near middle. Glandular organs conspicuous, 57-70 in number, variable in size and irregular in arrangement. Head slightly set off by a depression, 1/4th-1/3rd of body-width at base of esophagus. *En face* view showing six small lips of equal size each having an inner and an outer cephalic papilla. The four additional papillae which are usually present on the submedian lips imperceptible. Amphids cup-shaped, apertures 4-5 μ from anterior end, 7-8 μ or about 3/4ths the corresponding body-width wide. Sensillar pouches 16-19 μ from amphidial slits.

Spear measures 7-9 μ ventrally and 11-13 μ dorsally, its aperture 3-4 μ. Spear guiding ring single, 6-8 μ from anterior end. Spear extensions curved, 17-20 μ. Basal expanded portion of esophagus 27-30% of the total esophageal length, its

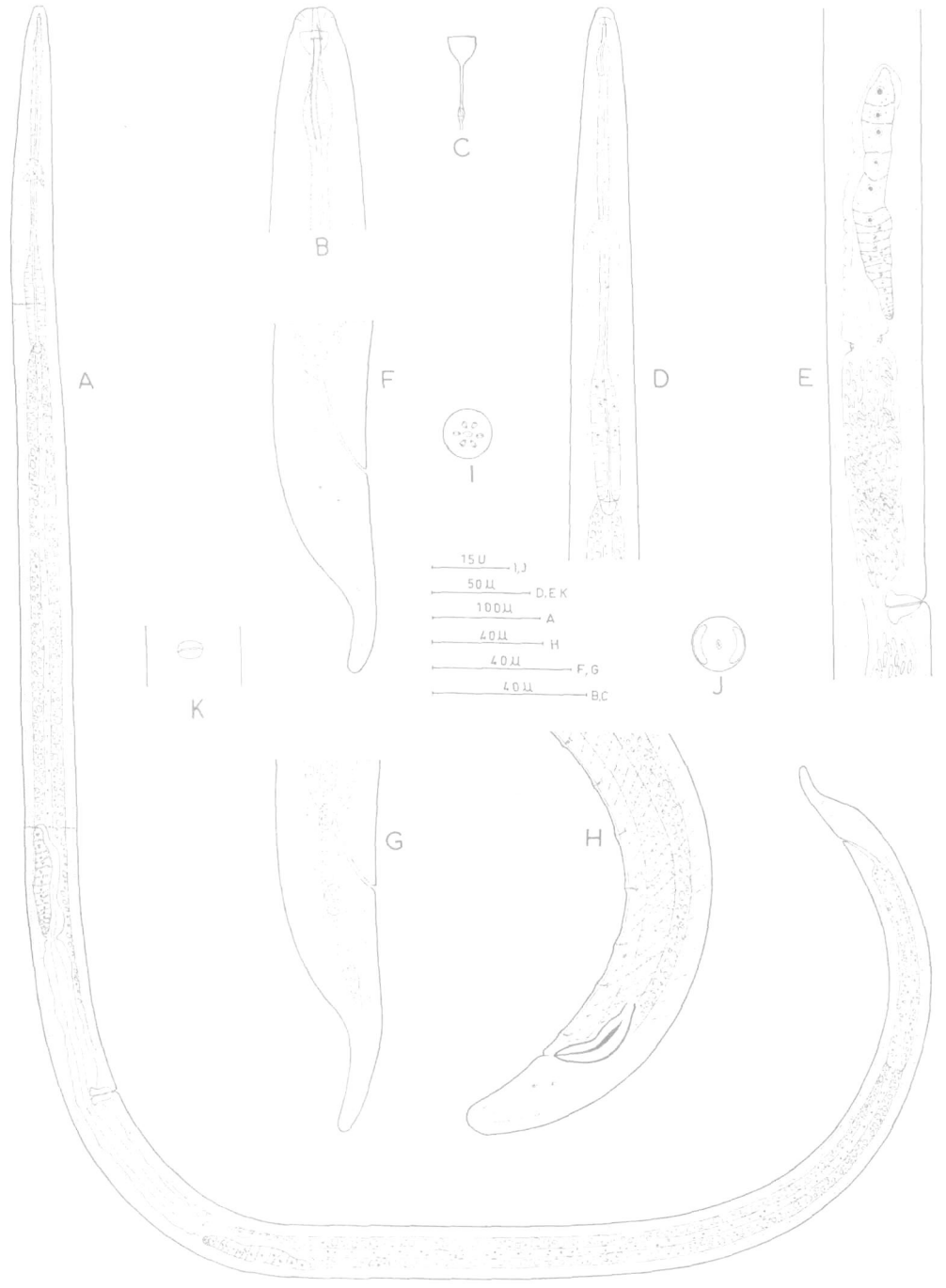

Fig. 1. *Morasia dimorphicauda* n. gen., n. sp. A — Entire female; B — Head end; C — Amphid; D — Esophageal region; E — Female gonad; F & G — Female tail; H — Male tail; I — *en face* view; J — C.S. 5 μ below anterior end at level of amphidial apertures; K — Vulva region.

width less than 1/3rd of body-width at base of esophagus and 1/6th-1/5th of its own length. Opening of dorsal esophageal gland 176-214 μ from anterior end. The first pair of subventral esophageal glands open 15-28 μ from dorsal esophageal gland opening and the second pair opens 12-18 μ below the opening of the first pair. Nerve ring 100-124 μ from anterior end. Cardia rounded.

Vulva a transverse slit. Vagina 19-24 μ long, extending about 1/2 across the body. Gonads amphidelphic. Oviduct and uterus distinctly separated by sphincter. Anterior sexual branch 163-318 μ and posterior 158-302 μ long. Uteri filled with sperms. Ovaries reflexed, oocytes arranged in a single row except at tip. Size of egg 114-118 $\times$ 27-37 μ. Prerectum 200-253 μ or about 7-9 times the anal body-width. Rectum about one anal body-width long. Tail 2.0-2.5 anal body-widths long, elongate-conoid with rounded terminus. Two minute caudal pores present.

Male: Supplements an adanal pair and 6-7 ventromedians, the latter begin at about 1.5 anal body-widths above the anus and spaced at somewhat irregular intervals. Spicules 36-40 μ long medially, about 1.5 anal body-widths long. Lateral guiding pieces obscure and difficult to measure. Tail rounded, about 1.5 anal body-widths long.

Type habitat and locality: *Bhognipur population*: Soil around roots of Cotton, *Gossypium arboreum* L. from Bhognipur, district Kanpur, U.P., India.

Other localities: Soil around roots of Cotton, *Gossypium herbaceum* L. from Bamanheri, district Muzaffarnagar, and Deoband, district Saharanpur, U.P., India.

Type specimens: Collected in October, 1967 by Qaiser H. Baqri; holotype along with one paratype male mounted on slide MSJ/*Morasia dimorphicauda*/1; paratypes on slides MSJ/*Morasia dimorphicauda*/2-3.

Specimens from Bamanheri and Deoband are mounted on slides MSJ/*Morasia dimorphicauda*/4-5.

Differential diagnosis: *Morasia dimorphicauda* n. sp. differs from the only other species of the genus in having a longer body (1.05 mm in *M. rhabdotus*); presence of glandular organs in the lateral hypodermal chords; tail shapes, and longer and differently shaped spicules (about one anal body-width long in *M. rhabdotus*).

DORYLAIMOIDES CONSTRICTUS N. SP.

(Fig. 2)

Dimensions:

Females (4): L = 0.82-0.85 mm; a = 38-40; b = 6.2-7.0; c = 7-9; V = $^{2.5\text{-}4.5}31\text{-}33^{11\text{-}16}$.

Female (holotype): L = 0.90 mm; a = 43; b = 7.0; c= 8.0; V = $^{3.5}30^{11}$.

Males (3): L = 0.80-0.86 mm; a = 41-44; b = 6.0-7.0; c = 9-11; T = 50-53.

Description:

Female: Body curved in posterior half of its length upon fixation and tapering gradually anterior to slender part of esophagus. Outer and inner cuticle finely

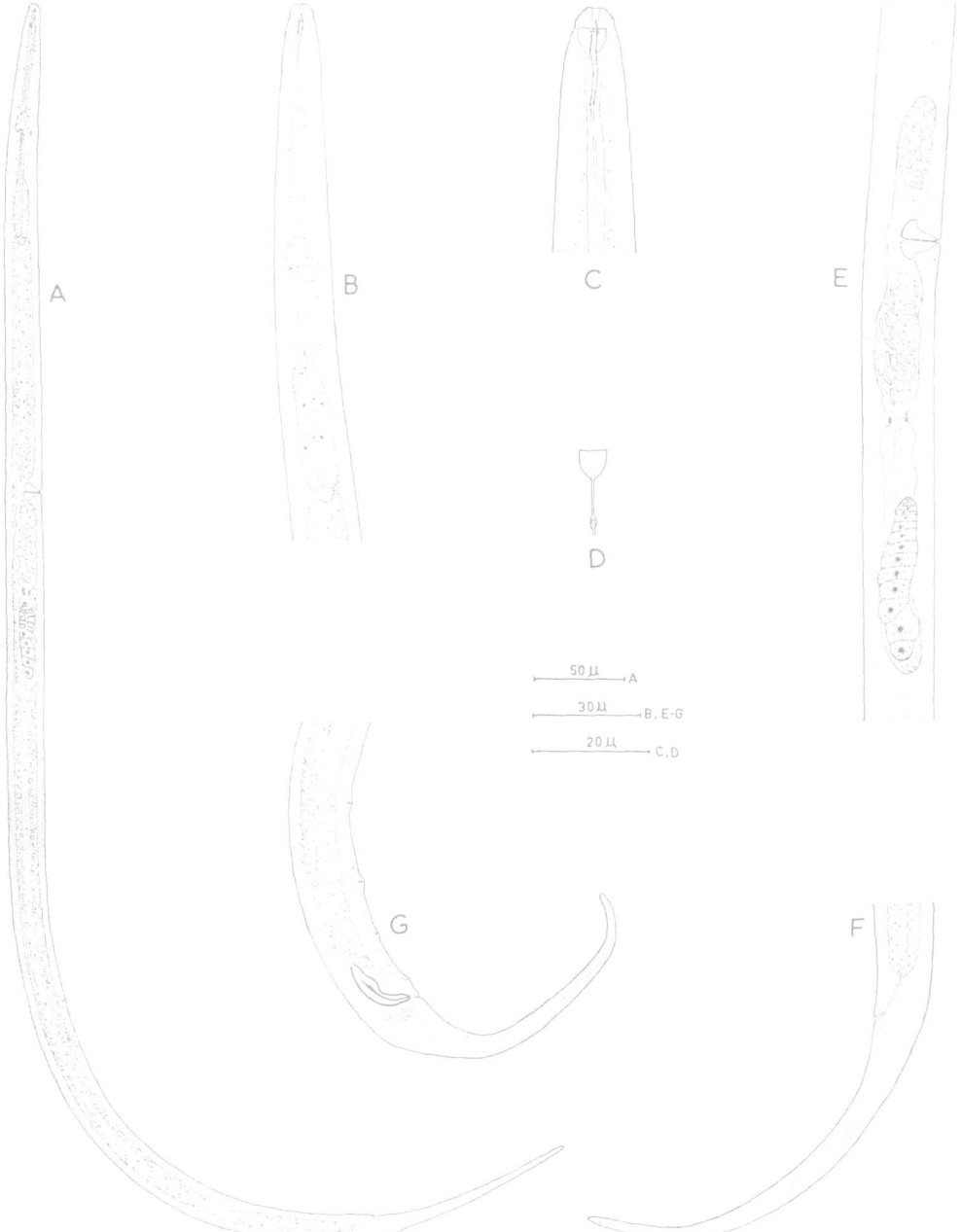

Fig. 2. *Dorylaimoides constrictus* n. sp. A — Entire female; B — Esophageal region; C — Head end; D — Amphid; E — Female gonad; F — Female tail; G — Male tail

striated. Lateral hypodermal chords 1/6th-1/5th body-width near middle. Head slightly set off by a depression, about 1/3rd body-width at base of esophagus. Amphids cup-shaped, apertures 3-4 μ from anterior end, 4-5 μ or about 3/4th the corresponding body-width wide. Sensillar pouches 13-14 μ from amphidial slits.

Spear measures 4-5 μ ventrally and 6-7 μ dorsally, its aperture 2 μ. Spear guiding ring single, 4-5 μ from anterior end. Spear extensions 9-11 μ long. Basal expanded portion of esophagus set off from anterior slender part by a constriction; 23-26% of the total esophageal length, its width slightly more than $\frac{1}{2}$ the body-width at base of esophagus and about $\frac{1}{4}$th-$\frac{1}{3}$rd of its own length. Opening of dorsal esophageal gland 103-119 μ from anterior end. The first pair of subventral esophageal glands open 7-13 μ from dorsal esophageal gland opening and the second pair opens 6-11 μ below the opening of the first pair. Nerve ring 62-70 μ from anterior end. Cardia rounded.

Vulva a transverse slit. Vagina 9-11 μ, extending about $\frac{1}{2}$ the corresponding body-width. Gonad single, opisthodelphic. Anterior uterine sac about 1-2 corresponding body-widths long. Posterior sexual branch measures 108-145 μ. Oviduct and uterus distinctly separated by sphincter. Ovary reflexed, oocytes arranged in a single row except at tip. Prerectum 63-80 μ or 5-6 anal body-widths long. Rectum slightly more than one anal body-width long. Tail long, filiform, 7-9 anal body-widths long. Caudal pores not observed.

Male: Supplements an adanal pair and 3 ventromedians, the latter begin slightly above the proximal end of the spicules, spaced at irregular intervals. Spicules 19-20 μ long medially. Lateral guiding pieces obscure. Tail filiform, about 6 anal body-widths long.

Type habitat and locality: Soil around roots of Sun hemp, *Crotalaria juncea* L. from Gyanpur, district Banaras, U.P., India.

Type specimens: Collected in October 1967 by Qaiser H. Baqri; holotype mounted on slide MSJ/*Dorylaimoides constrictus*/1 and paratypes on slide MSJ/*Dorylaimoides constrictus*/2.

Differential diagnosis: *D. constrictus* n. sp., comes close to *D. brevidens* Thorne, 1964 and *D. longiurus* Siddiqi, 1965. From the former it differs in the shape of lip region, amphids and spear; in having expanded portion of esophagus regular in contour (irregular in *D. brevidens*); shorter esophagus (b = 5.5 in *D. brevidens*) and absence of spermatheca. From *D. longiurus* it differs in the shape of lip region and spear; in having a constriction at the junction of anterior slender part and basal expanded portion of esophagus; longer prerectum (3.0-3.5 anal body-widths in *D. longiurus*); shorter and differently shaped spicules (23-24 μ in *D. longiurus*).

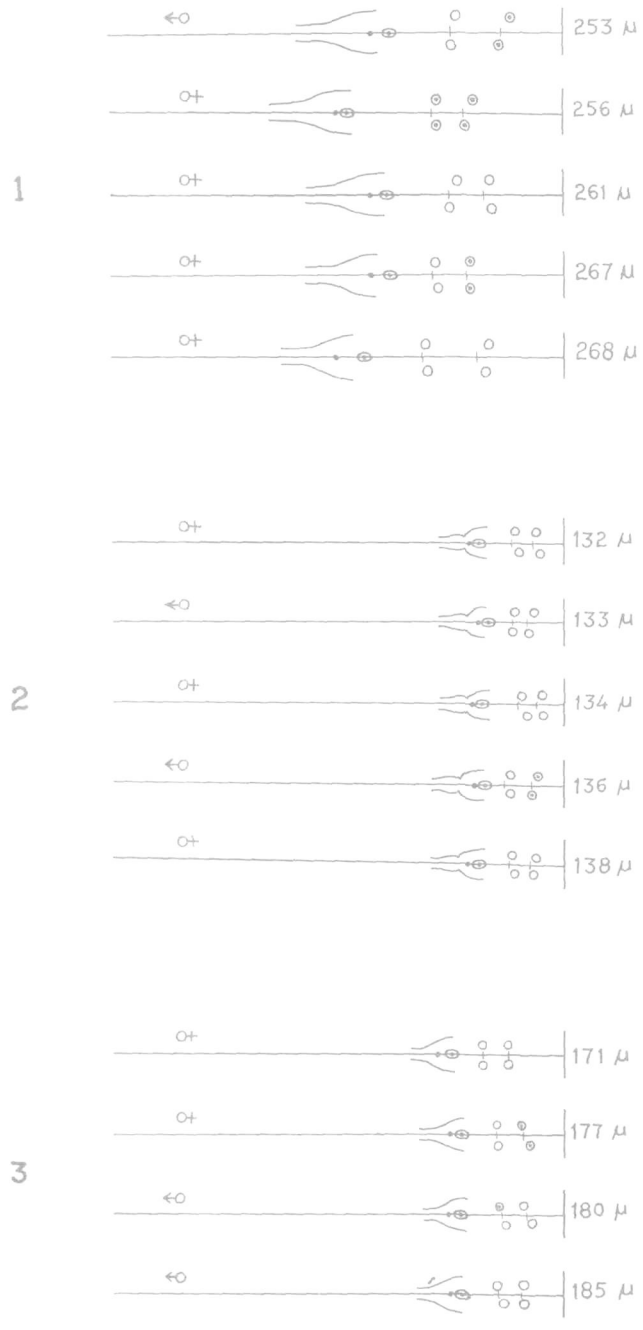

Fig. 3. Diagrams 1-3: 1 — *Morasia dimorphicauda*; 2 — *Dorylaimoides constrictus*; 3 — *Dorylaimoides saueri*.

DORYLAIMOIDES ARCUICAUDATUS N. SP.

(Fig. 4, A-F)

Dimensions:

Females (4): L = 1.24-1.40 mm; a = 31-36; b = 7.4-8.0; c = 27-29; V = $^{12\text{-}13}44\text{-}48^{11\text{-}13}$.

Female (holotype): L = 1.28 mm; a = 37; b = 7.1; c = 29; V = $^{12}49^{12}$.

Males (2): L = 1.30-1.41 mm; a = 37-38; b = 7.0-8.1; c = 26-31; T = 54-59.

Description:

Female: Body 'C' shaped upon fixation and tapering gradually anterior to slender part of esophagus. Outer and inner cuticle finely striated. Lateral hypodermal chords 1/7th-1/5th body-width near middle. Head set off, 1/5th-1/4th body-width at base of esophagus. Amphids cup-shaped, apertures 3-4 μ from anterior end, their width 5-6 μ or about 3/4th the corresponding body-width. Sensillar pouches 20-22 μ from amphidial slits.

Spear measures 7-10 μ ventrally and 10-13 μ dorsally, about 1.5 head widths long, its aperture 1/4th of its length. Spear guiding ring 6-7 μ from anterior end. Spear extensions 15-16 μ long. Basal expanded portion of esophagus 27-34% of the total esophageal length, its width about 1/3rd body-width at base of esophagus and 1/6th-1/5th of its own length. Opening of dorsal esophageal gland 126-144 μ from anterior end. The first pair of subventral esophageal glands open 13-18 μ from dorsal esophageal gland opening and the second pair opens 7-11 μ below the opening of the first pair. Nerve ring 86-93 μ from anterior end. Cardia rounded.

Vulva a transverse slit. Vagina 17-19 μ, extending 1/3rd-1/2 across the body. Gonads amphidelphic. Oviduct and uterus distinctly separated by a sphincter. Anterior sexual branch 170-195 μ and posterior 168-192 μ long. Ovaries reflexed, oocytes arranged in a single row except at tip. Prerectum 110-117 μ, about 6 anal body-widths long. Tail conoid, ventrally curved with rounded terminus, about 2.5 anal body-widths long. Two minute caudal pores present.

Male: Supplements an adanal pair and 5 ventromedians; the latter begin at about one anal body-width above the anus and are spaced at irregular intervals. Spicules 37-40 μ medially. Lateral guiding pieces obscure. Tail 2.0-2.5 anal body-widths long.

Type habitat and locality: Soil around roots of Patson, *Hibiscus cannabinus* L. from Karganwan, district Jhansi, U.P., India.

Type specimens: Collected in October, 1967 by Qaiser H. Baqri; holotype mounted on slide MSJ/*Dorylaimoides arcuicaudatus*/1; paratypes on slides MSJ/*Dorylaimoides arcuicaudatus*/2-3.

Differential diagnosis: *D. arcuicaudatus* n. sp., comes close to *D. elegans* (de Man, 1880) Thorne & Swanger, 1936 and *D. micoletzkyi* (de Man, 1921)

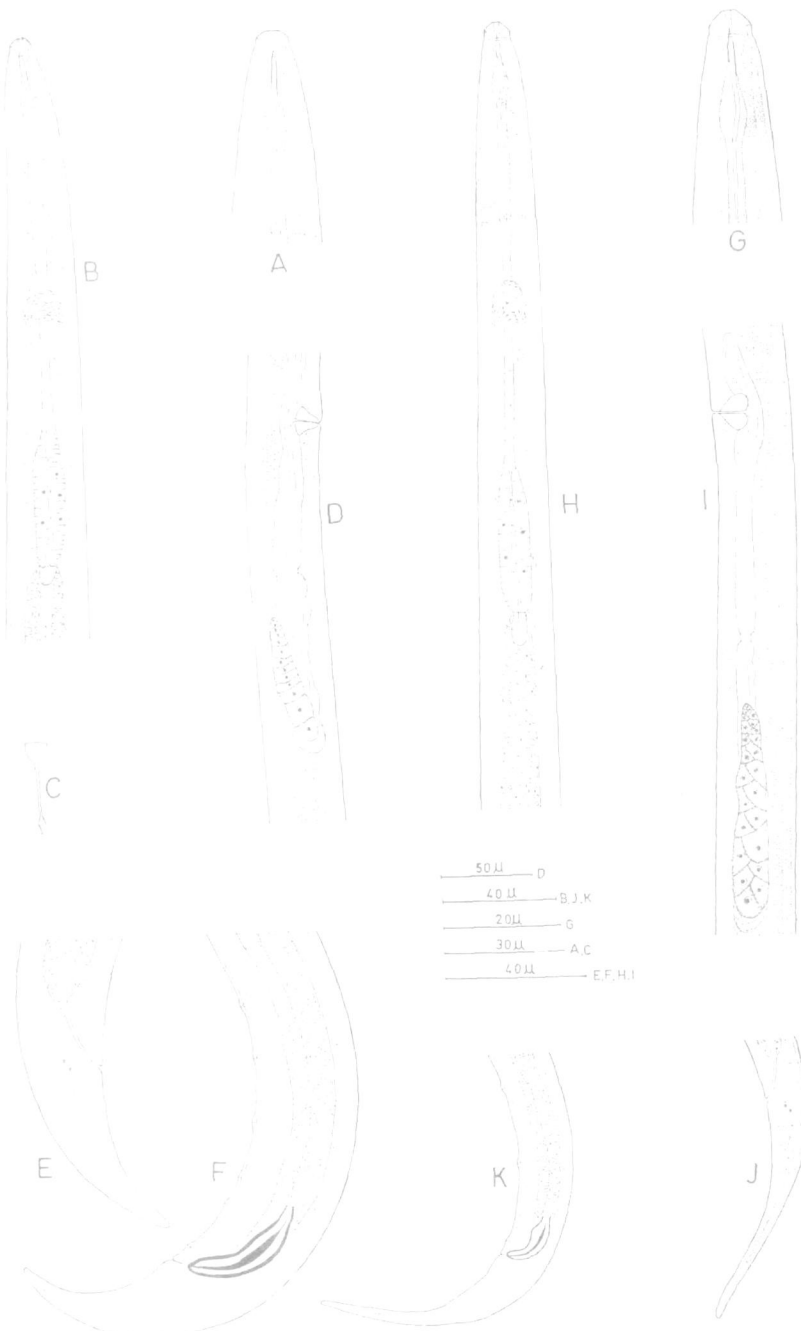

Fig. 4. A-F. *Dorylaimoides arcticaudatus* n. sp. A — Head end; B — Esophageal region; C — Amphid; D — Female gonad; E — Female tail; F — Male tail. G-K. *Dorylaimoides saueri* n. sp. G — Head end; H — Esophageal region; I — Female gonad; J — Female tail; K — Male tail

Thorne & Swanger, 1936. From the former it differs in shape of amphids, spear and tail; in having a smaller esophagus (b = 5.9 in *D. elegans*) and different arrangement of ventromedian supplements. From *D. micoletzkyi* it can be distinguished in having set- off lip region; shorter esophagus (b = 6.3 in *D. micoletzkyi*); longer spear, differently shaped tail and the arrangement of the ventromedian supplements.

DORYLAIMOIDES SAUERI N. SP.

(Fig. 4, G-K)

Dimensions:

Disond Hakimpur population (Type): Females (3): L = 0.80-0.90 mm; a = 36-39; b = 5.4-6.3; c = 9-11; V = $^{2.5\text{-}4.0}31\text{-}33^{13\text{-}16}$.

Female (holotype): L = 0.90 mm; a = 37; b = 5.1; c = 11; V = $^{2.6}33^{16}$.

Males (2): L = 0.88-0.95 mm; a = 35-44; b = 6.2-6.5; c = 12-13; T = 53-54.

Sakrar population: Male (1): L = 0.84 mm; a = 43; b = 5.9; c = 10; T = 50.

Description:

Female: Body curved in posterior half of its length upon fixation and tapering gradually anterior to slender part of esophagus. Outer cuticle and inner cuticle finely striated. Lateral hypodermal chords $^1/_6$th-$^1/_5$th body-width near middle. Head slightly set off, about $^1/_3$rd body-width at base of esophagus. Amphids cup-shaped, apertures 4 μ from anterior end, their width 4-5 μ or about $^3/_4$th the corresponding body-width. Sensillar pouches 15-16 μ from amphidial slits.

Spear measures 7 μ ventrally and 9-10 μ dorsally, more than one head-width long, its aperture 2 μ. Spear guiding ring 4-5 μ from anterior end. Spear extensions 12-13 μ long. Basal expanded portion of esophagus 22-25% of the total esophageal length, its width 1/2-1/2.5 body-width at base of esophagus and 1/5th-1/4th of its own length. Opening of dorsal esophageal gland 110-137 μ from anterior end. The first pair of subventral esophageal glands open 10-15 μ from the dorsal esophageal gland opening and the second pair opens 9-12 μ below the opening of the first pair. Nerve ring 80-90 μ from anterior end. Cardia rounded.

Vulva a transverse slit. Vagina 10-12 μ, extending slightly less than 1/2 across the body. Gonad single, opisthodelphic. Anterior uterine sac about 1-2 body-widths long. Posterior sexual branch 120-160 μ long. Oviduct and uterus distinctly separated by sphincter. Ovary reflexed, oocytes arranged in double rows. Prerectum 80-107 μ or 5-7 anal body-widths long. Rectum about one anal body-width long. Tail uniformly tapering, 5-6 anal body-widths long. Two minute caudal pores present.

Male: Supplements an adanal pair and 2-3 ventromedians, the latter begin 2 anal body-widths above the anus, spaced at irregular intervals. Spicules 19-22 μ medially. Lateral guiding pieces obscure. Tail about 5 anal body-widths long.

Type habitat and locality: *Disond Hakimpur population* (Type): Soil around roots of Cotton, *Gossypium herbaceum* L. from Disond Hakimpur, district Bijnor, U.P., India.

Sakrar population: Single male was collected from soil around roots of Sun hemp, *Crotaria juncea* L. from Sakrar, district Jhansi, U.P., India.

Type specimens: Collected in November, 1966 by Qaiser H. Baqri; holotype along with one paratype male mounted on slide MSJ/*Dorylaimoides saueri*/1; paratypes on slide MSJ/*Dorylaimoides saueri*/2.

Specimen from Sakrar mounted on slide MSJ/*Dorylaimoides saueri*/3.

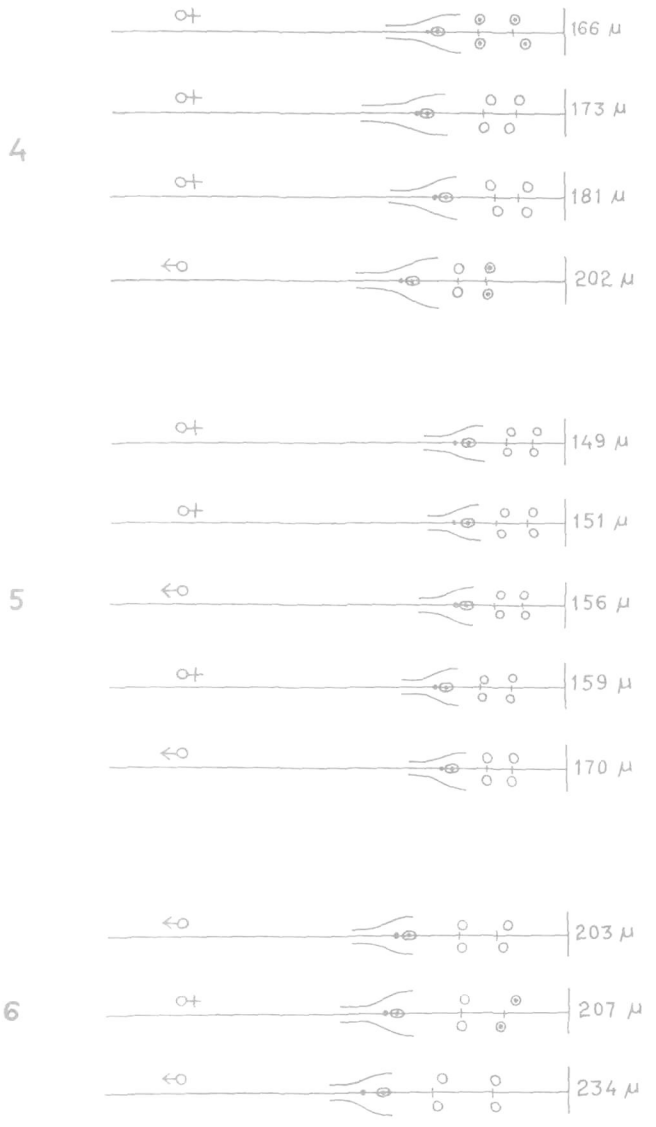

Fig. 5. Diagrams 4-6. 4 — *Dorylaimoides arcuicaudatus*; 5 — *Dorylaimoides arcuatus*; 6 — *Dorylaimoides parateres*.

Differential diagnosis: *D. saueri* n. sp., comes close to *D. paraconurus* Heyns, 1963 and *D. longiurus* Siddiqi, 1965. From the former it differs in having shorter body (L = 1.30-1.40 mm in *D. paraconurus*); smaller basal expanded portion of esophagus (more than 50% in *D. paraconurus*); differently shaped amphids; longer anterior uterine sac (about 1/2 the body-width in *D. paraconurus*); longer prerectum (1.5-2.0 anal body-widths long in *D. paraconurus*). From *D. longiurus* it differs in the shape of lip region and spear; in having a more than one head-width long spear (less than 1/2 head-width in *D. longiurus*); longer prerectum (3.0-3.5 anal body-widths long in *D. longiurus*); shorter tail (11 anal body-widths long in *D. longiurus*).

Named after M. R. Sauer, C.S.I.R.O., Horticultural Research Section, Merbein, Victoria, Australia.

DORYLAIMOIDES PARATERES SIDDIQI, 1964

(Fig. 6, A-C)

Dimensions:

Females (2): L = 1.27-1.47 mm; a = 37-40; b = 6.1-7.2; c = 47-50; V = $^{11}43\text{-}48^{10\text{-}12}$.

Males (2): L = 1.27-1.45 mm; a = 40-44; b = 5.9-6.0; c = 45-47; T = 59-62.

Description:

Male: (Males are hereby reported for the first time for this species). Supplemens an adanal pair and 7 ventromedians, the latter begin slightly over one anal body-width above the anus, spaced at irregular intervals. Spicules 35-36 μ long medially. Lateral guiding pieces obscure. Tail 1.0-1.5 anal body-widths long, rounded.

Habitat: Soil around the roots of Sun hemp, *Crotalaria juncea* L. from Gyanpur, district Banaras, U.P., India.

DORYLAIMOIDES ARCUATUS SIDDIQI, 1964

(Fig. 6, D-J)

The description of *D. arcuatus* by Siddiqi (1964) is based on a single female specimen. Now we have available 3 populations with a large number of specimens. It is therefore considered necessary to give a detailed description of females as well as males which are recorded here for the first time.

Dimensions:

Singhpur population: Females (10): L = 0.90 mm (0.81-0.96 mm); a = 44 (39-48); b = 5.8 (5.1-6.3); c = 16 (14-17); V = $^{3.5}35^{14}$ ($^{3\text{-}4}33\text{-}37^{10\text{-}17}$).

Males (5): L = 0.75-0.86 mm; a = 39-44; b = 5.2-5.9; c = 16-18; T = 53-58.

Paras-Ka-Banglaw population: Females (10): L = 0.89 mm (0.79-0.94 mm);

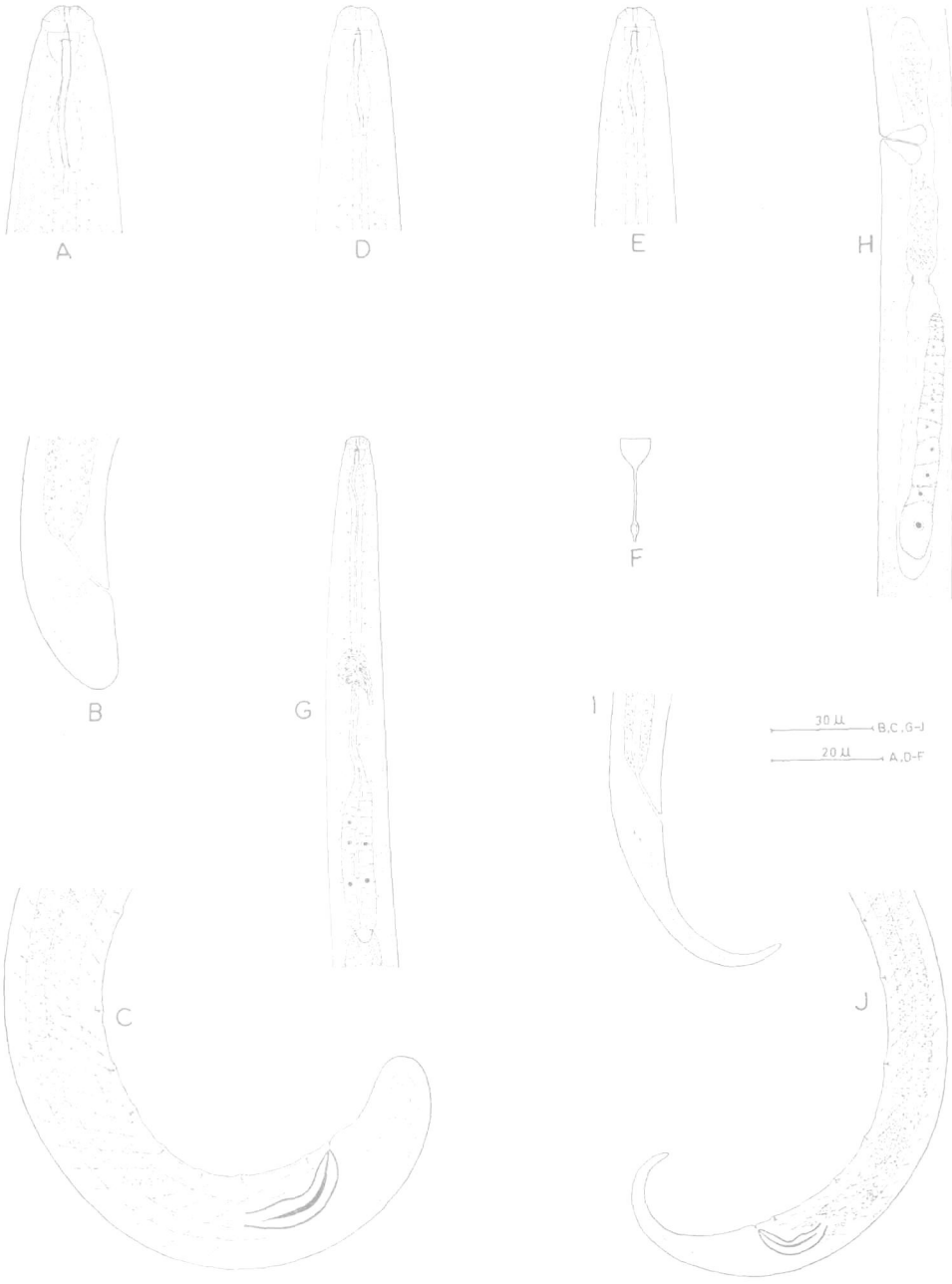

Fig. 6. A-C. *Dorylaimoides parateres*. A — Head end; B — Female tail; C — Male tail. D-J. *Dorylaimoides arcuatus*. D & E — Head end; F — Amphid; G — Esophageal region; H — Female gonad; I — Female tail; J — Male tail.

a = 39 (35-45); b = 6.2 (5.3-7.0); c = 16 (13-20); V = $^{2.5}3^{5}1^{5}$ ($^{2.0\text{-}3.5}33\text{-}37^{13\text{-}17}$).

Males (5): L = 0.75-0.89 mm; a = 38-45; b = 5.1-6.0; c = 14-17; T = 52-56.

Shairpur population: Females (10): L = 0.90 mm (0.78-1.02 mm); a = 44 (40-51); b = 5.9 (5.2-6.7); c = 16 (14-18); V = $^{3}3^{5}1^{5}$ ($^{2.5\text{-}4}32\text{-}37^{13\text{-}17}$).

Males (4): L = 0.75-0.94 mm; a = 41-49; b = 5.1-6.3; c = 16-17; T = 51-57.

Description:

Female: Body curved in posterior half of its length upon fixation and tapering gradually anterior to slender part of esophagus. Outer and inner cuticle finely striated. Lateral hypodermal chords 1/6th-1/5th of body-width near middle. Head set off by a depression, about 1/3rd of body width at base of esophagus. Amphids cup-shaped, apertures 3-4 μ from anterior end and about 3/4th the corresponding body-width wide. Sensillar pouches 15-17 μ from amphidial slits.

Spear measuring 4-5 μ ventrally and 6-7 μ dorsally, about one head-width long; its aperture about 2 μ. Spear guiding ring 4-5 μ from anterior end. Spear extensions 10-12 μ long. Basal expanded portion of esophagus 24-30% of the total esophageal length. Dorsal esophageal gland opening 110-120 μ from anterior end of body. The first pair of subventral esophageal glands open 12-16 μ from dorsal esophageal gland opening and the second pair opens 8-11 μ below the opening of the first pair. Nerve ring 70-80 μ from anterior end. Cardia rounded.

Vulva a transverse slit. Vagina 8-11 μ, extending about 1/2 across the body. Anterior uterine sac 1-2.5 times the corresponding body-width. Posterior sexual branch 122-160 μ long. Ovary reflexed, oocytes arranged in a single row except at tip. Prerectum 5-7 anal body-widths long. Tail ventrally arcuate, regularly tapering, 3.5-5.5 anal body-widths long. Two minute caudal pores present.

Male: Supplements an adanal pair and 3-5 ventromedians, the latter begin about 1.5 anal body-widths above the anus, spaced at irregular intervals. Spicules 20-22 μ medially. Lateral guiding pieces obscure. Tail as of female.

Habitats:

Singhpur and Shairpur populations: Soil around roots of Cotton, *Gossypium herbaceum* L. from Singhpur, district Moradabad, and Shairpur, district Etawah, U.P., India.

Paras-ka-Banglaw population: Soil around roots of Sun hemp, *Crotalaria juncea* L. from Paras-ka-Banglaw, district Kanpur, U.P., India.

The latest key to the species of the genus *Dorylaimoides* is by Siddiqi (1964) in which 18 species were included. Since then the following number of species have been added to this genus by various authors: 4 by Thorne (1964), one by Loof (1964), 2 by Timm (1964), one by Szczygiel (1965), 4 by Siddiqi (1965), one by Jairajpuri (1965), 4 by Sauer (1967) and 2 by Husain & Khan (1968).

In the present work 3 new species have been described and one has been shifted to a closely related new genus, *Morasia*. The presentation of an emended key is therefore needed.

KEY TO SPECIES OF DORYLAIMOIDES

1. Ovary single 2
   Ovaries paired 20
2. Tail less than one and a half anal body-widths long 3
   Tail 3 or more anal body-widths long 6
3. Tail digitate, dorsally convex-conoid . . . . . *dactylurus* Heyns, 1963
   Tail bluntly conoid 4
4. Lip region continuous, anterior slender part and basal expanded portion of esophagus not set off by a constriction . . . . . *pretoriensis* Heyns, 1963
   Lip region distinctly set off; anterior slender part and basal expanded portion of esophagus set off by a constriction 5
5. Spear almost straight; prerectum more than 9 anal body-widths long . . . *mitis* Sauer, 1967
   Spear curved; prerectum less than 6 anal body-widths long . . . . *angustus* Sauer, 1967
6. Vulva less than 3 body-widths posterior to base of esophagus . . . *conurus* Thorne, 1939
   Vulva more than 6 body-widths posterior to base of esophagus 7
7. Anterior slender part and basal expanded portion of esophagus set off by constriction . . 8
   Anterior slender part and basal expanded portion of esophagus not set off by constriction 9
8. Lip region continuous; basal expanded portion of esophagus irregular in contour; spermatheca present . . . . . *brevidens* Thorne, 1964
   Lip region set off; basal expanded portion of esophagus smooth in contour; spermatheca absent . . . . . *constrictus* n. sp.
9. Lip region cap-like; amphidial apertures occupy about 90% of the corresponding body-width . . . . . *rusticus* Timm, 1964
   Lip region not cap-like; amphidial apertures occupy about 75% or less of the corresponding body-width 10
10. Spear more than 1.4 head widths long 11
    Spear one head-width long or less 13
11. Lips angular; head set off by a deep constriction . . . . . *reversus* Thorne, 1964
    Lips amalgamated; head set off by a slight depression 12
12. Basal expanded portion of esophagus about 50% of esophageal length . *paraconurus* Heyns, 1963
    Basal expanded portion of esophagus about 25% of esophageal length . . . *saueri* n. sp.
13. Tail 11 anal body-widths long . . . . . *longiurus* Siddiqi, 1965
    Tail less than 6 anal body-widths long 14
14. Anterior uterine sac absent . . . . . *limnophilus* (de Man, 1880) Loof, 1964
    Anterior uterine sac present 15
15. Tail ventrally arcuate 16
    Tail convex-conoid, posterior end bent dorsally 17
16. Prerectum 5-6 anal body-widths long . . . . . *arcuatus* Siddiqi, 1964
    Prerectum one anal body-width long . . . . . *elongatus* Husain & Khan, 1968
17. Spear extensions forming pharyngeal cavity . . . . . *intermedius* Thorne, 1964
    Spear extensions not forming phatyngeal cavity 18
18. Spear straight; lip region continuous . . . . . *modestus* Siddiqi, 1965
    Spear curved; lip region slightly set off by a depression 19
19. Spear about one head-width long . . . *bulbosus* (Brzeski & Szczygiel, 1961) Szczygiel, 1965
    Spear about half head-width long . . . . . *venustus* Andrássy, 1959
20. Tail rounded or short bluntly-conoid 21
    Tail elongate-conoid or filiform 26
21. Anterior slender part and basal expanded portion of esophagus set off by constriction . . 22
    Anterior slender part and basal expanded portion of esophagus not set off by constriction 23
22. Spear narrow, almost straight . . . . . *websteri* Sauer, 1967
    Spear broad, curved . . . . . *buccinator* Sauer, 1967

23. Vulva at about 60% . . . . . *thecolaimus* Heyns, 1963
Vulva at less than 50% 24
24. Spear diverging at base; tail bluntly-conoid . . . . . *teres* Thorne & Swanger, 1936
Spear straight; tail rounded 25
25. Spear 10-12 μ long; basal expanded portion 1/4th the total esophageal length . . . . . *parateres* Siddiqi, 1964
Spear 7 μ long; basal expanded portion about 1/3rd the total esophageal length . . . . . *indicus* Jairajpuri, 1965
26. Tail less than 2.5 anal body-widths long 27
Tail more than 4 anal body-widths long 29
27. Tail digitate, posterior end bent dorsally . *micoletzkyi* (de Man, 1921) Thorne & Swanger, 1936
Tail subdigitate or ventrally arcuate 28
28. Tail ventrally arcuate; spear straight . . . . . *arcuicaudatus* n. sp.
Tail subdigitate; spear diverging at base . *elegans* (de Man, 1880) Thorne & Swanger, 1936
29. Tail elongate-conoid 30
Tail long, filiform 33
30. Lateral hypodermal chords with glandular organs; vulva at 35% . . . *similis* Thorne, 1964
Lateral hypodermal chords without glandular organs; vulva at more than 40% 31
31. Spear about 1.5 head-widths long . . . . . *porifer**) Loof, 1964
Spear about one head-width long 32
32. Prerectum 5 anal body-widths long; post-anal intestinal sac absent . *pakistanensis* Siddiqi, 1964
Prerectum about 2 anal body-widths long; post-anal intestinal sac present . . . . . *leptus* Husain & Khan, 1968
33. Tail more than 12 anal body-widths long . . . . . *longicaudatus* (Imamura, 1931) Thorne & Swanger, 1936
Tail less than 9 anal body-widths long 34
34. Spear straight 35
Spear arcuate or asymmetrical 36
35. Spear robust; body length 1.90-2.02 mm . . . . . *leptura* Siddiqi, 1965
Spear not robust; body length 0.97-1.25 mm . . . . . *elaboratus* Siddiqi, 1965
36. Ventromedian supplements 9-11 . . . . . *lepidus* Timm, 1964
Ventromedian supplements 3-6 37
37. Spear 3/4th head-width long . . . . . *paulbuchneri* Meyl, 1956
Spear more than one head-width long . . . . . *parvus* Thorne & Swanger, 1936

Not included in the key:

i) *Dorylaimoides stenodorus* Altherr, 1953 transferred to *Dorylaimus* by Hopper & Cairns (1959).
ii) *Dorylaimoides longidens* Furstenberg & Heyns, 1966 transferred to *Lenonchium* by Jairajpuri (1967).
iii) *Dorylaimoides riparius* Andrássy, 1962 considered a synonym of *D. limnophilus* (Loof, *in litt.*)
iv) *Dorylaimoides ditlevseni* (Micoletzky, 1922) transferred to *Calolaimus* by Timm (1964).

ZUSAMMENFASSUNG

Morasia *n. gen. und drei neue Arten der Gattung* Dorylaimoides *Thorne & Swanger, 1936 (Nematoda: Dorylaimoidea) aus Indien*

Es wird eine neue Gattung, *Morasia,* aufgestellt, die sich von *Dorylaimoides* durch den Geschlechtsdimorphismus der Schwanzform unterscheidet. Typenart ist *M. dimorphicauda* n. sp., die sich von *M. rhabdotus* (Kreis, 1930) n. comb. durch größere Körperlänge (1,5-1,9 mm gegen 1,1 mm) und durch das Vorkommen von gut ausgebildeten Seitenorganen unterscheidet. Weiterhin werden drei neue Arten von *Dorylaimoides* beschrieben. *D. constrictus* ist 0.8-0.9 mm lang, der Schwanz ist lang ausgezogen (6-9 Analbreiten). Beim Weibchen ist nur der hintere Ast des Geschlechtsapparates entwickelt. *D. saueri* unterscheidet sich von *D. constrictus* hauptsächlich durch

*) Transferred to a new genus *Poronemella* by Siddiqi (1969), but we do not agree with this and consider it to belong here.

den längeren Stachel und das Fehlen einer Einschnürung zwischen den zwei Teilen des Oesophagus. *D. arcuticaudatus* hat eine Körperlänge von 1,2-1,4 mm und beide weiblichen Gonaden sind vollentwickelt; er steht *D. elegans* (de Man) und *D. micoletzkyi* (de Man) nahe, unterscheidet sich aber von beiden durch Schwanzform, längeren Oesophagus und Anordnung der männlichen Supplemente. Die bisher unbekannten Männchen von *D. arcuatus* Siddiqi und *D. parateres* Siddiqi werden beschrieben. Schliesslich wird eine Bestimmungstabelle für *Dorylaimoides* gegeben.

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TWO KNOWN AND THREE NEW SPECIES OF NEMATODES ASSOCIATED WITH FIBROUS CROPS IN INDIA

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SUMMARY

Two known and three new species of nematodes belonging to the genera *Tylenchus* (Bastian, 1865), *Telotylenchus* (Siddiqi, 1960), and *Discolaimium* (Thorne, 1939), were found in soil around roots of fibrous crops in India. The known species *Tylenchus (Clavilenchus) tumidus* (Colbran, 1960; Jairajpuri, 1966), and *Discolaimium bulbiferum* (Cobb, 1906); Timm and Bhuiyan, 1963, are new records for India. The new species, *Tylenchus (Clavilenchus) ritteri* n. sp., 0.47-0.68 mm. long having 9-10 μ long spear; excretory pore 2-4 annules posterior to hemizonid; the entire tail annulated and tail tip swollen but irregularly notched. *Telotylenchus acrolatus* n. sp., 0.67-0.84 mm. long having 16-18 μ long spear; acrolated lateral fields; lip region marked with 8-9 striae and tail 2.5 to 3.7 anal body widths long. *Discolaimium mukhtarpuriensis* n. sp., 0.90-1.18 mm. long; having deep amphidial pouches; spear 16-18 μ long; spear extension 15-17 μ; basal enlarged portion of esophagus about one-third of the total esophageal length and tail dorsally convex-conoid with a rounded tip, about one and a half anal body widths long.

During the survey of nematodes of fibrous crops in India the following species were recorded: *Tylenchus (Clavilenchus) tumidus* (Colbran, 1960), Jairajpuri, 1966), *Tylenchus (Clavilenchus) ritteri* (1) n. sp.; *Telotylenchus acrolatus* n. sp.; *Discolaimium bulbiferum* (Cobb, 1906; Timm and Bhuiyan, 1963), and *Discolaimium mukhtarpuriensis* n. sp. The known species are here recorded for the first time from India.

All the specimens used in this study were killed in hot 4 p. 100 formalin and mounted in dehydrated glycerine by the slow method. Type material is deposited with the Zoology Museum of Aligarh Muslim University, Aligarh, U. P., India.

(1) Named after Dr. M. Ritter.

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GENUS TYLENCHUS BASTIAN, 1865
SUBGENUS CLAVILENCHUS (1) JAIRAJPURI, 1966

Tylenchus (Clavilenchus) tumidus (COLBRAN, 1960) JAIRAJPURI, 1966

Dimensions:

Females (6) :
L = 0.42-0.57 mm ; *a* = 27-42 ; *b* = 4.8-6.5 ; *c* = 7-9 ; V = 73-86
Males (6) :
L = 0.41-0.56 mm ; *a* = 27-39 ; *b* = 5.2-6.5; *c* = 7-10 ; T = 43-56

Habitat:

Soil around roots of cotton, *Gossypium* sp., from Mukhtarpur, District Bijnore, U. P., India.

Tylenchus (Clavilenchus) ritteri n. sp. (fig. 1)

Dimensions:

i) *Deoband population* (Type population):

Females (4) :
L = 0.48-0.59 mm ; *a* = 29-37 ; *b* = 4.5-5.3 ; *c* = 9-13 ; V = 72-77

Female (holotype) :
L = 0.61 mm ; *a* = 38 ; *b* = 5.1 ; *c* = 9 ; V = 75
Male (1) :
L = 0.59 mm ; *a* = 34 ; *b* = 5.1 ; *c* = 9 ; T = 30

ii) *Malpura population:*

Females (3) :
L = 0.57-0.68 mm ; *a* = 34-38 ; *b* = 5.3-6.5 ; *c* = 9-11 ; V = 71-75
Males (2) :
L = 0.47-0.61 mm ; *a* = 36-44 ; *b* = 5.9-6.1 ; *c* = 9 ; T = 29-42

Description:

Female.

Body slightly ventrally arcuate when relaxed. Cuticle with distinct transverse striations, each about 1 μ apart. Lateral fields about a quarter of body width, marked with four incisures. Amphidial apertures 3 μ wide, slit-like, situated posterior to base of lateral lips. Deirids not seen. Hemizonid prominent, 2-4 annules above the excretory pore.

Head slightly set off by a depression from the body, smoothly rounded. Spear slender, 9-10 μ, knobbed at base, the anterior tapering tip 3-4 μ. Orifice of the dorsal esophageal gland situated 3 μ behind base of spear. Distance from anterior end of body to the centre of the median bulb about half of the distance from the latter to the base of esophagus. Corpus ovate with distinct valvular apparatus. Isthmus

(1) After this paper was sent for publication, Thorne and Malek (1968) have raised the subgenus *Clavilenchus* Jairajpuri, 1966 to and Independent genus *Clavilenchus* (Jairajpuri, 1966) Thorne and Malek, *Tylenchus (Clavilenchus) ritteri* now becomes *Clavilenchus ritteri*.

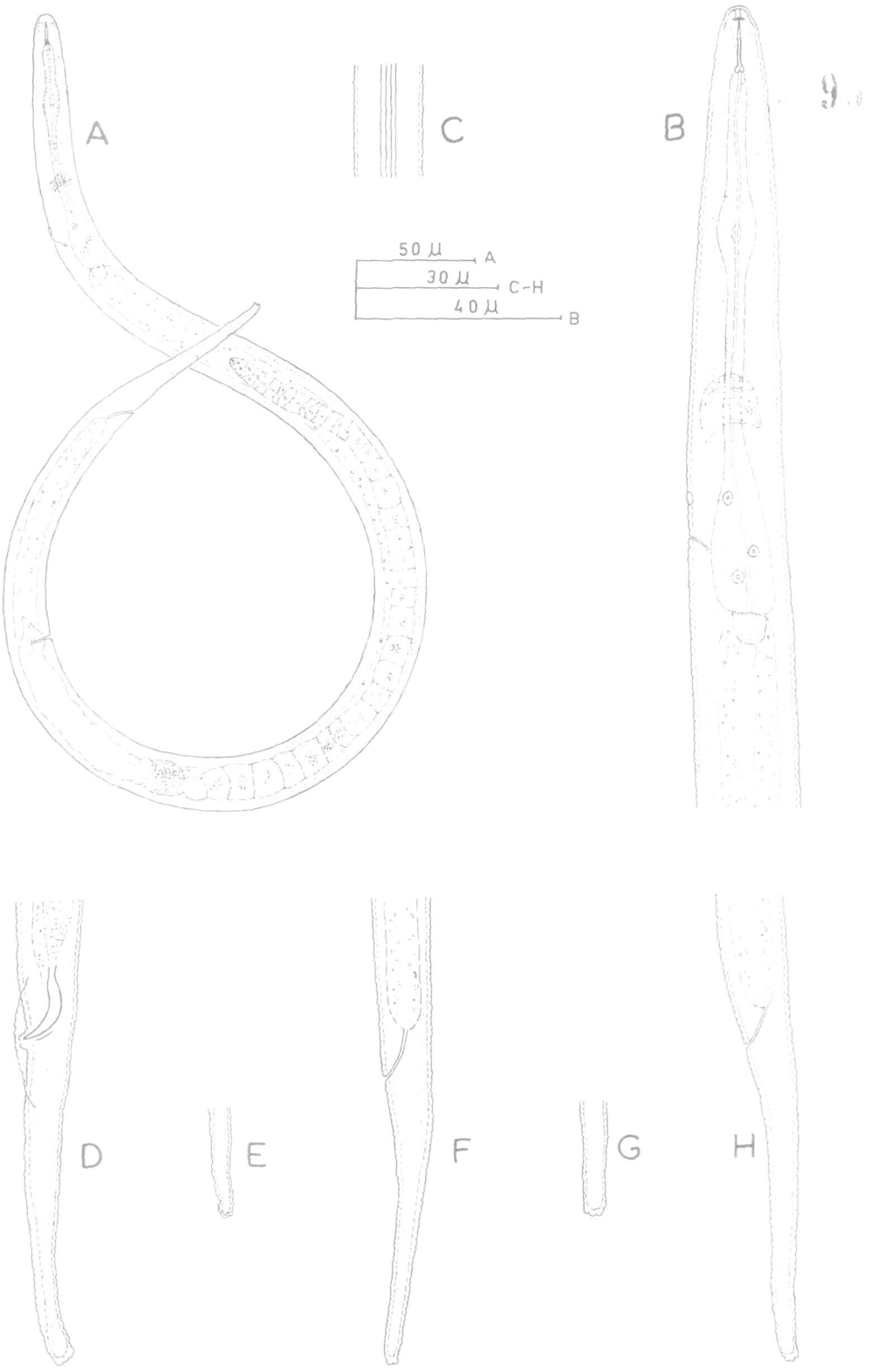

FIG. 1. — *Tylenchus (Clavilenchus) ritteri* n. sp.

A: Entire female; B: Esophageal region; C: Lateral field; D: Tail end, male; F and H: Tail ends, female; E and G: Tail tips

narrower than procorpus in Deoband population but nearly of the same thickness in Malpura population. Nerve ring 57-69 μ from the anterior end. Basal esophageal bulb pyriform. Cardia rounded.

Vulva a transverse slit. Vagina about half of the corresponding body width. Ovary single, prodelphic, outstretched ; oocytes arranged in a single row except at the tip. Posterior uterine sac more than half of the corresponding body width. Rectum 9-11 μ, about one anal body width. Tail elongate, filiform, about 5-8 times the anal body width, with a swollen but irregularly notched tip.

Male.

Similar to female in general morphology. Testis single outstretched. Spicules 16-17 μ, arcuate. Gubernaculum 4-5 μ, slightly arcuate. Bursa with crenate margins. Tail as in female.

Habitat :

Deoband population (Type) : Soil around roots of cotton, *Gossypium herbaceum* L., from Deoband, District Saharanpur, U. P., India.

Malpura population : Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Malpura, District Agra, U. P., India.

Type specimens :

Collected in October 1966, by Mr. QAISER H. BAQRI ; holotype mounted on slide MSJ *Tylenchus* (*Clavilenchus*) *ritteri*/1 ; paratypes on slide MSJ/*Tylenchus* (*Clavilenchus*) *ritteri*/2 ; specimens from Malpura, Agra on slide MSJ/*Tylenchus* (*Clavilenchus*) *ritteri*/3.

Differential diagnosis :

Tylenchus (*Clavilenchus*) *ritteri* n. sp., comes close to *Tylenchus* (*Clavilenchus*) *tumidus*, the type and the only species under the subgenus *Clavilenchus* (JAIRAJPURI, 1966), but differs in having a smaller spear, in the position of excretory pore, the entire tail annulated and the tail tip swollen but irregularly notched.

GENUS TELOTYLENCHUS SIDDIQI, 1960

Telotylenchus acrolatus n. sp. (fig. 2)

Dimensions :

Females (3) :

L = 0.71-0.80 mm ; a = 34-38 ; b = 4.4-5.7 ; c = 15-19 ; V = 52-55

Males (4) :

L = 0.67-0.74 mm ; a = 33-37 ; b = 4.3-4.6 ; c = 12-16 ; T = 47-55

Female (holotype) :

L = 0.84 mm ; a = 35 ; b = 5.1 ; c = 14 ; V = 51

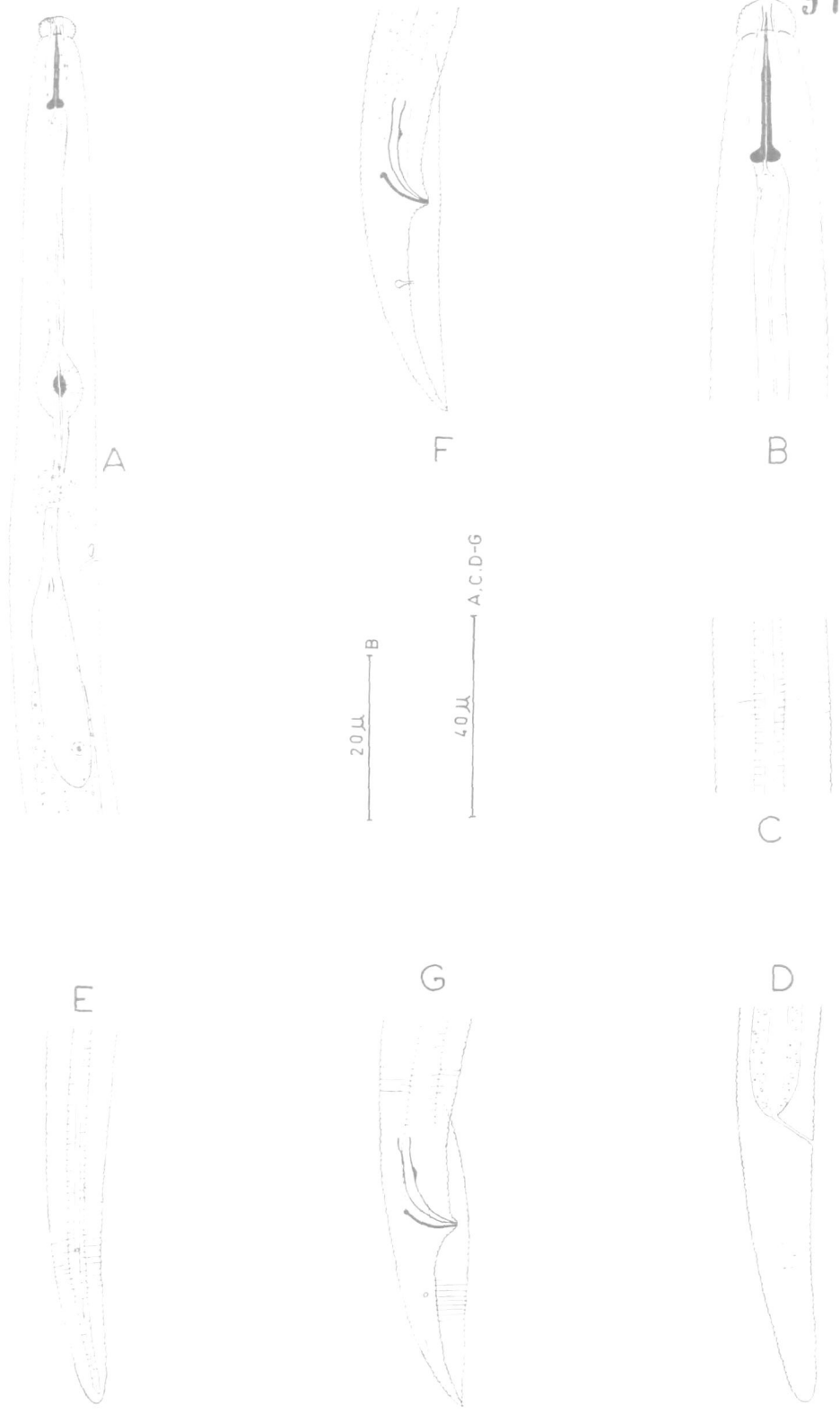

FIG. 2. — *Telotylenchus aerolatus* n. sp.

A : Œsophageal region; B : Head end, C : Lateral field near middle of body; D and E : Female tails; F and G : Male tails

Description :

Female : Body slightly curved in posterior half of its length or often "C" shaped when relaxed and tapering slightly towards extremities. Cuticle marked with distinct transverse striae about 1 μ apart. Longitudinal striations absent. Lateral fields originate with 2 incisures near base of spear, become 3 near middle of procorpus and 4 slightly below the median esophageal bulb. These 4 incisures continue slightly below the phasmids on tail, then the inner 2 incisures fuse together and the 3 incisures continue up to the tail terminus. Outer incisures are crenate while the inner slightly irregularly wavey. Width of lateral fields 1/4th to 1/3rd of body width near middle. Lateral fields irregularly aerolated throughout the length of incisures.

Lip region well set off, flat at apex, marked by 8-9 striae. Head framework sclerotized. Spear 16-18 μ long, stout, anterior part (metenchium) 7-8 μ or 43-44 p. 100 of spear length. Base of spear with 3 large and rounded posteriorly slopping knobs, about 4 μ wide. Esophagus consists of a long cylindrical procorpus, a median bulb and a posterior esophageal gland lobe. Median esophageal bulb ovate, 14-15 μ long and 9-10 μ wide and with a very distinct valvular apparatus in the centre. Esophageal gland lobe formed by one dorsal and 2 subventral esophageal glands, overlapping the intestine for about 2 body widths. Orifice of dorsal esophageal gland 1-2 μ from spear base. Nerve ring 89-104 μ from anterior end, along middle of isthmus. Excretory pore 104-114 μ from anterior end, opposite to the junctinn of esophageal gland lobe with intestine. Hemizonid 2-3 striae long, situated 1-7 striae above the excretory pore. Deirids at level of hemizonid.

Vulva transverse. Vagina 10-12 μ across the body, about half of the corresponding body width. Gonads amphidelphic, outstretched. Each sexual branch consists of an ovary, oviduct, spermatheca and uterus. Spermatheca large, spherical, filled with sperms. Tail elongate, cylindrical with rounded smooth terminus, marked with 31-37 striae and 2.9-3.7 anal body widths long. Phasmids in anterior third of tail.

Male : Similar to female in general morphology. Testis single outstretched. Spicules slightly arcuate, 22-24 μ long medialy. Gubernaculum 11-13 μ long, proximal end knobbed. Bursa well developed with crenate margins. Four incisures of lateral fields gradually expand on tail end and faint away. Only the outer incisure of the dorsal side reaches beyond phasmids, the 3 others disappear at or above the level of anus. Anus with protruding lips. Phasmids near middle of tail. Tail elongate conoid, 2.5-3 anal body widths long.

Habitat :

Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Barwe Sagar, District Jhansi, U. P., India.

Type specimens :

Collected in October 1967, by Mr. QAISER H. BAQRI ; holotype mounted on slide MSJ/*Telotylenchus aerolatus*/1 ; paratypes on slides MSJ/*Telotylenchus aerolatus*/2-4.

Differential diagnosis :

Telotylenchus aerolatus n. sp., comes closest to *T. indicus* (SIDDIQI, 1960), and *T. ventralis* (LOOF, 1963). From the former it differs in having a longer esophagus,

larger number of striae on the lip region, orifice of dorsal esophageal gland close to spear base, prominent hemizonid, metenchium shorter than posterior cylindrical shaft of the spear, posteriorly slopping spear knobs and differently shaped spicules. From *T. ventralis* it differs in having longer esophagus, no expansion and contraction of body near vulva, differently shaped and shorter spicules. From both these species it can also be separated in having aerolated lateral fields, inner incisures wavy and in the manner of determination of incisures on female tail.

GENUS DISCOLAIMIUM THORNE, 1939

Discolaimium bulbiferum (Cobb, 1906 ; Timm and Bhuiyan, 1963)

Dimensions :

i) *Ghazipur population :*

Females (6) :

L = 1.46-1.66 mm ; a = 54-60 ; b = 4.4-5.0 ; c = 33-47 ; V = $^{6-8}$44-47$^{6-7}$

ii) *Ajanta population :*

Female (1) :

L = 1.52 mm ; a = 46 ; b = 4.7 ; c = 46 ; V = ^{8}46^{7}

Description :

Cuticle smooth, about 1 μ thick. Lateral chords about one-fourth to one-fifth body width near middle. Glandular organs 100-115, irregularly arranged. Spear 10-13 μ long, about equal to head width. Spear guiding ring 6-8 μ from anterior end. Spear extensions 18-21 μ in length. Basal expanded portion of esophagus occupies 51-54 p. 100 of the total esophageal length (about 2/3rd according to Torne, 1939). Prerectum 40-48 μ, about 2-3 times the anal body width. Tail dorsally convex-conoid, terminus subacute, more than two anal body widths long.

Habitat :

Ghazipur population : Soil around roots of Patsoi, *Habiscus cannabinus* L., from Ghazipur, U. P., India.

Ajanta population : Soil around roots of Sunn hemp *Crotalaria juncea* L., near Ajanta caves, Maharashtra, India.

Discolaimium mukhtarpuriensis n. sp. (fig. 3)

Dimensions : i) Ghazipur population

i) *Mukhtarpur population* (Type population) :

Females (2) :

L = 1.12-1.16 mm ; a = 33-34 ; b = 4.1-4.8 ; c = 35-41 ; V = $^{7-8}$52-57$^{9-10}$

Female (holotype) :

L = 1.18 mm ; a = 33 ; b = 5.0 ; c = 38 ; V = ^{11}53^{14}

ii) *Pahasu population :*

Female (1) :

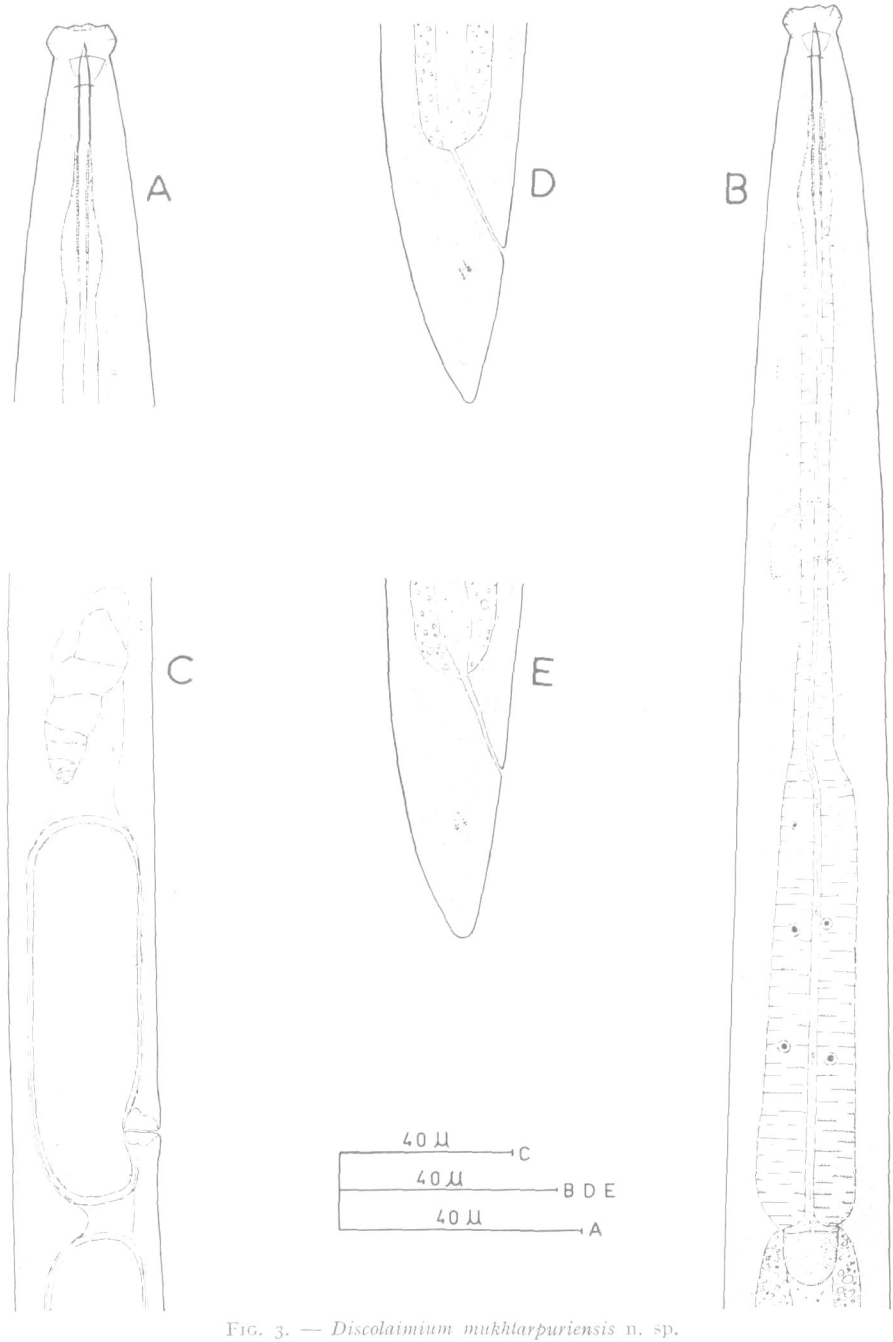

FIG. 3. — *Discolaimium mukhtarpuriensis* n. sp.
A: Head end; B: Esophageal region;
C: Anterior sexual branch; D and E: Tail ends

L = 0.90 mm ; $a = 35$; $b = 4.5$; $c = 31$; V = $^{9}57^{11}$ 101

iii) *Nagla Fatehabad population :*

Female (1) :

L = 1.08 mm ; $a = 32$; $b = 4.4$; $c = 32$; V = $^{11}54^{11}$

iv) *Ghazipur population :*

Females (2) :

L = 1.10-1.14 mm ; $a = 37$-39 ; $b = 4.8$; $c = 31$-37 ; V = $^{9-12}52$-53^{8-9}

Description :

Body slightly curved in posterior third of its length when relaxed and tapering gradually anterior to slender part of esophagus. Cuticle smooth, its thickness varies between 1-3 μ at various places in the body (3 μ thick at tail). Subcuticle with faint striations, less than 1 μ thick. Head well set off, its width less than half of body width at base of esophagus. Lips somewhat conoid, modifying the head contour and bearing the usual number of cephalic papillae. Lateral chords one-fourth to one-fifth of body width near middle. Amphids cup-like, their apertures 4-5 μ from anterior end and occupying 5-6 μ or more than one half of corresponding body width. Sensillar pouches not seen.

Spear 16-18 μ long, cylindrical ; aperture 5-6 μ. Guiding ring 9-10 μ from anterior end. Spear extension simple, 15-17 μ. Basal expanded portion of esophagus occupies 33-36 p. 100 of the total esophageal length, its width about one half of body width at base of esophagus and 1/5-6th of its own length. Opening of the dorsal esophageal gland 134-152 μ or 57-63 p. 100 of the esophageal length from anterior end. The first pair of subventral esophageal glands open 21-26 μ from the dorsal esophageal gland opening ; the second pair opens 27-30 μ behind the opening of the first pair. Nerve ring 99-114 μ from anterior end. Cardia rounded, esophago-intestinal disc present.

Vulva is a transverse slit. Vagina 9-10 μ extending about one-third to one-fourth across the body. Gonads amphidelphic. Combined length of oviduct and uterus 80-125 μ and 104-126 μ of the anterior and posterior sexual branch respectively. No sperms in the uteri. Ovaries reflexed ; oocytes arranged in a single row except at the tip. Size of eggs 85-89 × 24-32 μ. Prerectum 72-102 μ or about 3 1/2 to 5 1/2 times the anal body width. Rectum 18-22 μ. about equal to anal body width. Tail dorsally convex-conoid with a rounded terminus, about one and a half anal body widths long. Two minute caudal pores present.

Male : Not found.

Habitat :

Mukhtarpur population (Type) : Soil around roots of cotton, *Gossypium herbaceum* L., from Mukhtarpur, District Bijnore, U. P., India.

Pahasu population : Soil around roots of Sunn hemp, *Crotalaria juncea* L., from Pahasu, District Bulandshahr, U. P., India.

Nagla Fatehabad population : Soil around roots of Patson, *Hibiscus cannabinus* L. from Nagla Fatehabad, District Bulandshahr, U. P., India.

Ghazipur population : Soil around roots of cotton, *Gossypium hirsutum* L., from Ghazipur, U. P., India.

Type specimens:

Collected in November, 1966, by Mr. QAISER, H. BAQRI ; holotype along with 2 paratypes on slide MSJ/*Discolaimium mukhtarpuriensis*/1. Specimens from Pahasu, Nagla Fatehabad and Ghazipur on slides MSJ/*Discolaimium mukhtarpuriensis*/2-4.

Differential diagnosis:

Discolaimium mukhtarpuriensis n. sp., comes close to *D. simplex* (SIDDIQI, 1965) but differs in having a smaller and stouter body ; deep amphidial pouches, smaller spear extension, smaller enlarged portion of esophagus and vulva postequatorial.

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RÉSUMÉ

DEUX ESPÈCES CONNUES ET TROIS ESPÈCES NOUVELLES DE NÉMATODES ASSOCIÉES AUX CULTURES DE PLANTES A FIBRES EN INDE

Cinq espèces appartenant aux genres ; *Tylenchus* (BASTIAN, 1865), *Telotylenchus* (SIDDIQI, 1960), et *Discolaimium* (THORNE, 1939), ont été trouvées dans les sols au voisinage de racines de chanvre en Inde. Parmi ces cinq espèces, trois sont nouvelles. Les deux autres : *Tylenchus* (*Clavilenchus*) *tumidus* (COLBRAN, 1960 ; JAIRAJPURI, 1966) et *Discolaimium bulbiferum* (COBB, 1906 ; TIMM and BHUIYAN, 1963), sont signalées pour la première fois dans ce pays. *Tylenchus* (*Clavilenchus*) *ritteri* n. sp., se caractérise par une taille comprise entre 0,47-0,68 mm ; un stylet de 9 à 10 µ ; la position du pore excréteur, 1 à 4 anneaux après l'hémizonide, une queue entièrement annelée munie d'une extrémité lisse mais irrégulièrement découpée.

Telotylenchus aerolatus n. sp., 0,67-0,84 mm. possède un stylet atteignant 16-18 µ ; ses champs latéraux sont aérolés et la région labiale marquée par 8 à 9 stries ; sa queue dépasse de 2,5 à 3,7 fois le diamètre anal.

Discolaimium mukhtarpuriensis n. sp. 0,90-1,18 mm, porte de profondes chambres amphidiales ; le stylet mesure 16 à 18 µ et son extension 15-17 µ ; la partie basale élargie de l'œsophage (bulbe) atteint 2/3 de la longueur totale de l'œsophage ; la queue est dorsalement convexe-conique avec une extrémité arrondie, sa longueur dépasse d'une fois et demie la largeur du corps à l'anus

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ON THE INTRA-SPECIFIC VARIATIONS OF *TYLENCHORHYNCHUS MASHHOODI* SIDDIQI & BASIR, 1959 AND AN EMENDED KEY TO SPECIES OF *TYLENCHORHYNCHUS* COBB, 1913 (Nematoda) [1]

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(With 37 text-figures)

The survey of plant and soil nematodes associated with fibrous crops in Uttar Pradesh, India revealed that the species of this genus are widely distributed. The following species of *Tylenchorhynchus* were collected: *Tylenchorhynchus capitatus* Allen, 1955; *T. brevidens* Allen, 1955; *T. martini* Fielding, 1956; *T. mashhoodi* Siddiqi & Basir, 1959; *T. divittatus* Siddiqi, 1961; *T. brassicae* Siddiqi, 1961 and *T. goffarti* Sturhan, 1966. A detailed morphological study of *T. mashhoodi* based on specimens collected from several localities revealed that this species shows intra-specific variations in the shape of lip region, shape of tail in female, width of annules, number of annules on tail, and in the shape and length of gubernaculum. The following species which are very similar to *T. mashhoodi* fall well within its variations and are therefore regarded as its synonym: *Tylenchorhynchus dactylurus* Das, 1960; *T. digitatus* Das, 1960; *T.crassicaudatus* Williams, 1960; *T. elegans* Siddiqi, 1961 and *T. zeae* Sethi & Swarup, 1968. *Tylenchorhynchus martini* from Banbasa, district Nainital conforms well with the type specimens of this species studied by us. *Tylenchorhynchus goffarti* which is known only from Canary Island is recorded here for the first time from India (Figs. 29-32). Specimens of *T. divittatus* although similar to those described by SIDDIQI (1961) show important variation in the character of tail (Figs. 33-37).

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959

(Figs. 1 a 28)

Syn.: *Tylenchorhynchus dactylurus; T. digitatus; T. crassicaudatus; T. elegans; T. zeae.*

Dimensions — See Table I.

Description — Female: Body curved in posterior half of its length upon fixation and tapering slightly towards extremities. Cuticle marked with distinct transverse striae, 1-2 μ apart. Longitudinal striations absent. Lateral fields originate with two incisures near middle of spear, become three near middle of procorpus and four at the level of nervering; the outer ones are crenate. The four incisures extend up to the tail terminus. There is no indication of

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TABLE I

Dimensions of Tylenchorhyanchus mashhoodi

Population	No. of specimens	Length in mm	a	b	c	V/T
Deoband	40 (♀ ♀)	0.63 (0.54—0.72)	32 (28—37)	5.1 (4.4—5.8)	16 (13—18)	56 (52—58)
	15 (♂ ♂)	0.62 (0.57—0.66)	30 (27—35)	5.2 (4.5—5.6)	16 (14—17)	46 (36—50)
Shamli	9 (♀ ♀)	(0.49—0.62)	29—38	4.7—6.5	16—22	50—59
	2 (♂ ♂)	0.47—0.62	28—34	4.6—5.2	15—17	44—46
Mehalwala	3 (♀ ♀)	0.56—0.60	30—33	4.7—5.1	15—17	55—56
Dabathwa	3 (♀ ♀)	0.56—0.60	29—31	5.0—5.2	15—17	56—58
	2 (♂ ♂)	0.51—0.61	28—30	4.8—5.1	15—16	38—40
Sanda Brona	10 (♀ ♀)	0.58—0.65	29—37	5.3—5.8	13—19	55—58
	3 (♂ ♂)	0.58—0.69	33—34	5.3—5.8	14—16	45—50
Banatwa	6 (♀ ♀)	0.59—0.68	28—33	4.6—5.5	15—17	53—57
Kaishupur	5 (♀ ♀)	0.51—0.61	29—33	4.8—5.4	14—17	54—56
Personpur	8 (♀ ♀)	0.58—0.69	31—36	5.0—5.5	15—18	53—57
	2 (♂ ♂)	0.50—0.56	30—33	4.7—5.4	15—17	47—51
Hyderabad	7 (♀ ♀)	0.59—0.69	32—37	5.0—5.4	14—18	52—57

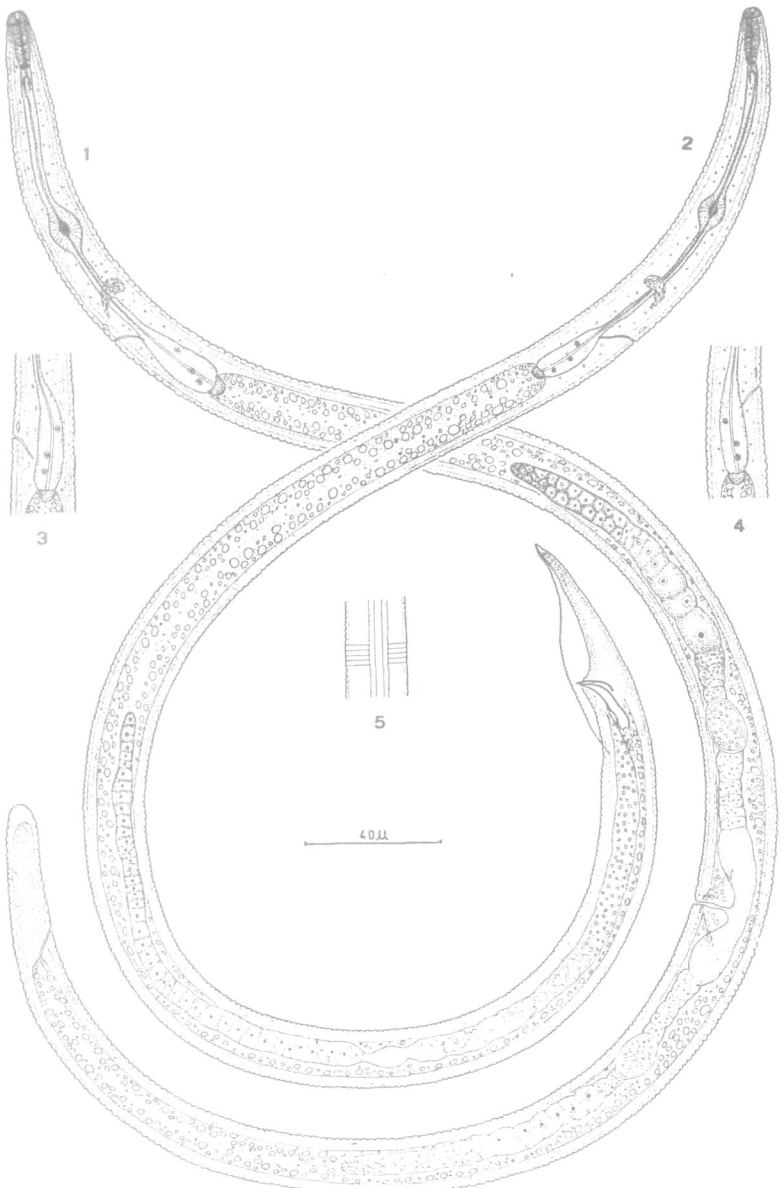
aerolations. Width of lateral fields 1/4th--1/3rd the body-width near middle.

Lip region continuous with body contour, flate at apex, bearing 3-4 annules, 6-7 μ wide and 3-4 μ high. Head frame--work slightly sclerotized. Spear 16-19 μ long, delicate, anterior part (metenchium) 8-10 μ long or 50-55% of spear length. Base of spear with three large, rounded or slightly pointed knobs, 3-4 μ wide. Esophagus typical. Median esophageal bulb ovate; at 44-50% of the esophageal length from anterior end; 11-15 μ long and 6-10 μ wide. Orifice of dorsal esophageal gland 1-3 μ from spear base. Nerve ring 75-104 μ from anterior end, along middle of isthmus. Excretory pore 85-122 μ from anterior end, its position varies between anterior end to slightly below the middle of terminal bulb. Hemizonid prominent, 1-2 annules long, situated 1-3 annules above the excretory pore.

Vulva a transverse slit. Vagina extending 7-11 μ across the body, 1/3rd-1/2 the corresponding body-width. Gonads amphidelphic, outstratched. Each sexual branch consists of an ovary, oviduct, spermatheca and uterus. Spermatheca ovate or spherical and filled with sperms. Oocytes arranged in a single row, double at the tip. Tail narrowing behind anus, cylindrical or subcylindrical in shape; ending in flat, rounded, broadly rounded, bluntly conoid or notched (in one specimen) terminus; marked with 14-29 striae ventrally and 2.5-4.0 anal body--widths long. Phasmids in the anterior half (28-37%) of the tail.

Male: The four incisures of the lateral fields gradually expand on the tail. The outer incisure of dorsal side reaches beyond phasmids and faint away; while that of ventral side reaches near the proximal end of spicules. The inner two reach up to the latitude of anus. Spicules 18-22 μ long medially. Gubernaculum stout, 10-15 μ long, proximal half slightly or distinctly curved upwards and often with a minute knob. Tail elongate-conoid with acute or subacute terminus; 2.3-3.0 anal body-widths long. Phasmids in the anterior half to way (31-50%) of the tail.

Discussion — DAS (1960) described *Tylenchorhynchus dactylurus* and *T. digitatus* which are quite similar to each other in many respects. He separated them on the basis that the male tail of *T. digitatus* is shorter and conoid and the female tail straight, while in *T. dactylurus* the female tail is marked by slight constriction posterior to anus. All the other characters including the body dimensions are almost identical. WILLIAMS (1960) reported *Tylenchorhynchus crassicaudatus* from Mauritius and separated it from *T. martini* by its more anteriorly situated phasmids and by the presence of a spermatheca. SIDDIQI (1961) described *Tylenchorhynchus elegans* from India and differentiated it from *T. mashoodi* and *T. digitatus*. As pointed out by SIDDIQI (l.c.) *T. elegans* differs from. T. *mashhoodi* in having less coarsely striated cuticle, a



Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959 — Fig. 1: Entire female; fig. 2: entire male; figs. 3-4: esophageal gland lobes; fig. 5: lateral fields near midbody.

weak buccal spear and a longer tail bearing 23 annules and from *T. digitatus* by a coarsely striated body cuticle, a smaller buccal spear and spicules. A recently described species, *Tylenchorhynchus zeae* Sethi & Swarup, 1968 differs from *T. mashhoodi* by its longer and differently shaped tail.

The above mentioned species were mostly described on small number of specimens and variations were not studied. The present study on *Tylenchorhynchus mashhoodi* is based on large number of specimens from different localities which show great variations in the length and shape of tails, number of tail annules (14-29), length of spear (16-19 μ), length and shape of spicules and gubernaculum. It is quite evident from the present study as well as examination of the type specimens of *Tylenchorhynchus mashhoodi, T. crassicaudatus, T. elegans* and *T. zeae* that they fall well within the variations of *T. mashhoodi*. Unfortunately, the type specimens of *Tylenchorhynchus dactylurus* and *T. digitatus* were not available for our study, but the descriptions as provided by Das (1960) as well as study of specimens collected from and around the type locality fail to show any significant difference from *T. mashhoodi* and fall well within its variations. They are therefore also regarded as synonyms of *T. mashhoodi*.

Differential diagnosis — *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959 comes very close to *Tylenchorhynchus martini* Fielding, 1956, but differs only in having a spermatheca and by the presence of males.

Habitats — i) Soil around roots of Cotton, *Gossypium herbaceum* L. from Deoband, district Saharnpur; Shamli, district Muzaffarnagar; Mahalwala and Dabathwa, district Meerut; and Kaishupur, district Etawah, U.P., India.

ii) Soil around roots of Sun hemp, *Crotalaria juncea* L. from Sanda Brona, district Allahabad; Banatwa, district Banaras, U.P., India.

iii) Soil around roots of Patson, *Hibiscus cannabinus* L. from Personpur, district Mirzapur, U.P., India.

iv) Soil around roots of Sugar cane, *Saccharum officinarum* L. from Hyderabad, Andhra Pradesh, India.

Tylenchorhynchus martini Fielding, 1956

Dimensions — Louisiana population (Topotypes): Females (11): L= 0.68 mm (0.63-0.73 mm); a= 34 (30-38); b= 4.8 (4.3-5.3); c= 14 (13-15); V= 56 (53-58). *Banbasa population*: Females (12): L= 0.72 mm (0.61-0.85 mm); a= 35 (31-37); b= 5.1 (4.6-5.7); c= 14 (12-15); V= 55 (52-57).

Description — Female: Cuticule transversely striated, 1-2 μ apart, farther apart on tail. Longitudinal striations absent. Lateral fields 1/4th-1/3rd the body-width near middle. Lip region continuous with body contour, set off by a slight depression in topotypes; flat or rounded at apex; bearing three annules, 3 μ high and 7 μ wide. Spear 17-19 μ long, anterior part (metenchium) 9-10 μ or 50-55% of spear length. Esophagus typical. Excretory pore 97-112 μ from anterior end. Hemizonid 1-2 striae long, situated 1-4 striae above the excretory pore. Spermatheca absent. Tail cylindrical or subcylindrical; ending in a smooth, broadly rounded, narrowly rounded or flat terminus; marked with 21-36 striae ventrally and about 3.0-4.8 anal body-widths long. Phasmids at 34-37% of the tail.

Habitats — Louisiana population (Topotypes): From soil around roots of Sugarcane hybrid, *Saccharum officinarum* L. from Laplace, Louisiana. *Banbasa population*: From soil around roots of Patson, *Hibiscus cannabinus* L. from Banbasa, district Nainital, U.P., India.

Tylenchorhynchus goffarti Sturhan, 1966

(Figs. 29-32)

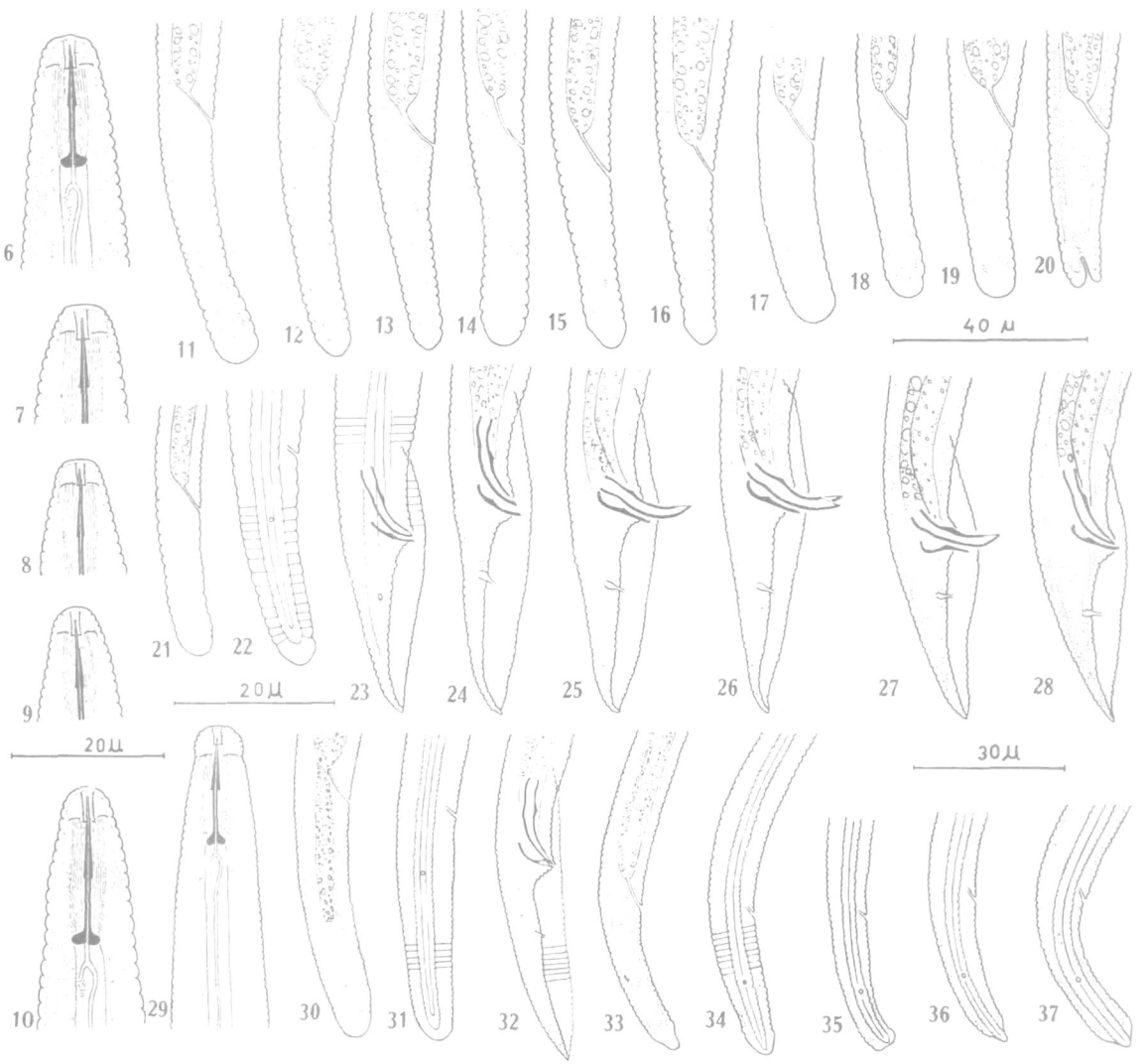
Dimensions — Females (7): L= 0.60--0.69 mm; a= 34-40; b= 5.1-5.9; c= 12-14;

V= 53-57. Males (5): L= 0.52-0.67 mm; a= 35-43; b= 5.0-5.8; c= 12-15; T= 41-51.

The Indian specimens conform well with the description of the species as provided by STURHAN (1966) as well as with the specimens examined by us.

Habitat — From soil around roots of Patson, *Hibiscus cannabinus* L. from Gyanpur, district Banaras, U.P., India.

species in the key. Since then, several species of *Tylenchorhynchus* have been described: 4 STURHAN (1966) (3 of which were not included by GUIRAN), one GEREART (1966), one SESHADRI *et al.* (1967), 2 CHAWLA *et al.* (1968), 4 SETHI & SWARUP (1968), 6 THORNE & MALEK (1968) and one JAIRAJPURI & BAQRI (1968). In the present work 5 known species which were regarded as



Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959 — Figs. 6-10: Head ends; figs 11-21: female tails; fig. 22: female tail, surface view; fig. 23: male tail, surface view; figs. 24-28: male tails. *Tylenchorhynchus goffarti* Sturhan, 1966 — Fig. 29: Head end; fig. 30: female tail; fig. 31: female tail, surface view; fig. 32: male tail. *Tylenchorhynchus divittatus* Siddiqi, 1961 — Fig. 33: Female tail; figs. 34-37: female tails, surface view.

The latest key to the species of the genus *Tylenchorhynchus* is by GUIRAN (1967). The latter author has included 71 valid by GUIRAN (l.c.) have shown to be synonyms. The presentation of an emended key is therefore inevitable.

KEY TO SPECIES OF *TYLENCHORHYNCHUS*

1. Cuticle marked with both longitudinal and transverse striae 2
   Cuticle marked with transverse striae only 16
2. Striae form distinct squares on the cuticle 3
   Striae do not form squares 11
3. Lateral fields areolated; phasmids large scutella-like ..... *mamillatus* Tobar-Jimenez, 1966
   Lateral fields not areolated; phasmids of normal size 4
4. Labial annules 2-4 5
   Labial annules 6-7 7
5. Longitudinal striae 29; tail 1.7 anal body-widths long ..... *claytoni* Steiner, 1937
   Longitudinal striae less than 24; tail about 2.5 anal body-widths long 6
6. Spear 20-22 μ; post-anal intestinal sac present ..... *stegus* Thorne & Malek, 1968
   Spear 13-15 μ; post-anal intestinal sac absent ..... *pachys* Thorne & Malek, 1968
7. Tail terminus striated 8
   Tail terminus smooth 9
8. Longitudinal striae 48, diminishing in posterior half of body ..... *tessellatus* Goodey, 1952
   Longitudinal striae 16, continue up to posterior extremity ..... *hexincisus* Jairajpuri & Baqri, 1968
9. Head sclerotization conspicuous; spear 24 μ ..... *tartuensis* Krall, 1959
   Head sclerotization inconspicuous; spear 18--22 μ 10
10. Longitudinal striae 30; tail cylindrical ..... *quadrifer* Andrássy, 1954
    Longitudinal striae 24; tail conical ..... *lenorus* Brown, 1956
11. Longitudinal striae confined to esophageal region ..... *brevilineatus* Williams, 1960
    Longitudinal striae extend up to tail region. 12
12. Tail terminus striated 13
    Tail terminus smooth 14
13. Lip region continuous; spear 24-28 μ ..... *lamelliferus* (de Man, 1880) Filipjev, 1936
    Lip region offset; spear 21 μ ..... *judithae* Andrássy, 1962
14. Female tail marked with 22 striae; bursa distally recurved ..... *phaseoli* Sethi & Swarup, 1968
    Female tail marked with 30-55 striae; bursa of normal shape 15
15. Spear 24-27 μ ..... *microphasmis* Loof, 1959
    Spear 19-22 μ ..... *sulcatus* Guiran, 1967
16. Lateral lines 3-4 17
    Lateral lines 5-6 53
17. Lateral lines 3 18
    Lateral lines 4 23
18. Lip region offset 19
    Lip region continuous 20
19. Spear 19-22 μ; tail striae 42-46 ..... *bifasciatus* Andrássy, 1961
    Spear 16-17 μ; tail striae 14-24 ..... *divittatus* Siddiqi, 1961
20. Tail about 6 anal body-widths long; tail terminus striated ..... *rhopalocercus* Seinhorst, 1963
    Tail 2-3 anal body-widths long; tail terminus smooth 21
21. Labial annules 4 ... *triglyphus* Seinhorst, 1963
    Labial annules 2-3 22
22. *Head sclerotization conspicuous, spear 22 μ* ..... *sculptus* Seinhorst, 1963
    Head sclerotization inconspicuous; spear 25--28 μ ..... *chonai* Sethi & Swarup, 1968
23. Tail terminus striated 24
    Tail terminus smooth 33
24. Lip region offset 25
    Lip region continuous 26
25. Labial annules 7; tail striae 46-48 ..... *dubius* (Bütschli, 1873) Filipjev, 1936
    Labial annules 6; tail striae about 60 ..... *canalis* Thorne & Malek, 1968
26. Spear 37-38 μ; tail about one anal body-width long ..... *brevicaudatus* Hopper, 1959
    Spear less than 30; tail more than 2 anal body--widths long 27
27. Labial annules 3; tail clavate, about 4 anal body-widths long ..... *clavicaudatus* Seinhorst, 1963
    Labial annules 4-7; tail not clavate, less than 3.5 anal body-widths long 28
28. Head sclerotization conspicuous; spear 27-30 μ ..... *magnicauda* (Thorne, 1935), Filipjev, 1936
    Head sclerotization inconspicuous; spear less than 24 μ 29
29. Labial annules 4; tail conoid ..... *eremicolus* Allen, 1955
    Labial annules 5-7; tail cylindrical or subcylindrical 30
30. Tail 2 anal body-widths long ..... *husingi* Paetzold, 1958
    Tail more than 2.5 anal body-widths long 31
31. Spear 17-18 μ ..... *parvus* Allen, 1955
    Spear 20-24 μ 32
32. Body 1.0-1.4 mm; labial annules 7; lateral fields not areolated ... *maximus* Allen, 1955
    Body 0.7-0.8 mm; labial annules 5-7; lateral fields areolated: ... *bryobius* Sturhan, 1966

33. Body 1.68 mm; spear 31-39 μ ..... *galeatus* Litvinova, 1946
Body 1 mm or less; spear less than 31 μ .. 34

34. Lip region smooth ..... *robustus* Thorne & Malek, 1968
Lip region bearing annules 35

35. Labial annules 2 36
Labial annules 3 or more 37

36. Spear 19-23 μ ..... *nudus* Allen, 1955
Spear 14-16 μ .. *delhiensis* Chawla et al., 1968

37. Tail hook-shaped with cuticular flaps ..... *bursifer* Loof, 1959
Tail conical, cylindrical or subcylindrical 38

38. Lip region offset 39
Lip region continuous 44

39. Spear 24-27 μ ..... *cylindricus* Cobb, 1913
Spear less than 23 μ 40

40. Post-anal intestinal sac present ..... *goffarti* Sturhan, 1966
Post-anal intestinal sac absent 41

41. Tail 2.2 anal body-widths long, marked with 14-15 striae ..... *latus* Allen, 1955
Tail more than 2.5 anal body-widths long, marked with more than 18 striae 42

42. Spear 15-17 μ ..... *brassicae* Siddiqi, 1961
Spear 18-23 μ 43

43. Spear 20-23 μ; tail shape cylindrical with hemispherical tip ..... *agri* Ferris, 1963
Spear 18-20 μ; tail shape conical with bluntly pointed tip ..... *aduncus* Guiran, 1967

44. Spear 28-31 μ; tail striae 51-58 ..... *kegenicus* Litvinova, 1946
Spear less than 26 μ; tail striae less than 40 45

45. Body 0.8-1.0 mm; spear 23-26 μ ..... *silvaticus* Ferris, 1963
Body less than 0.75 mm; spear less than 22 μ 46

46. Body ventrally contracted posterior to vulva ..... *contractus* Loof, 1964
Body not ventrally contracted posterior to vulva 47

47. Labial annules 3-4 48
Labial annules 5-6 50

48. Post-anal intestinal sac present ..... *ewingi* Hopper, 1959
Post-anal intestinal sac absent 49

49. Males frequently found; spermatheca present ..... *mashhoodi* Siddiqi & Basir, 1959
Males never recorded; spermatheca absent ... . *martini* Fielding, 1956

50. Labial annules 6; tail striae 35-38 ..... *manubriatus* Litvinova, 1946
Labial annules 5; tail striae less than 30 51

51. Head sclerotization conspicuous; spear 21-22 μ ..... *ebriensis* Seinhorst, 1963
Head sclerotization inconspicuous; spear 15--17 μ 52

52. Tail striae 10-15 ..... *clarus* Allen, 1955
Tail striae 20-27 ..... *striatus* Allen, 1955

53. Lateral lines 5 54
Lateral lines 6 61

54. Tail terminus striated; spear 20-24 μ ..... *goodeyi* Marınari, 1962
Tail terminus smooth; spear 16-18 μ 55

55. Labial annules 4-5 56
Labial annules 6-8 57

56. Body 0.48-0.63 mm; lip region rounded; spermatheca absent ..... *curvus* Williams, 1960
Body 0.8 mm; lip region flat; spermatheca an elongate pouch, 2-3 body-widths long ..... *acutoides* Thorne & Malek, 1968

57. Basal esophageal bulb slightly overlaps the intestine 58
Basal esophageal bulb does not overlap the Intestine 60

58. Tail about 2 anal body-widths long ..... *acutus* Allen, 1955
Tail about 3 anal body-widths long 59

59. Tail striae 23; cardia conspicuous ..... *cacti* Chawla et al., 1968
Tail striae 36-46; caria inconspicuous ..... *nilgriensis* Seshadri et al., 1967

60. Tail terminus bluntly pointed; tail striae 32-33 ..... *capitatus* Allen, 1955
Tail terminus hemispherical; tail striae 42-53 ..... *acti* Hopper, 1959

61. Tail terminus striated 62
Tail terminus smooth 69

62. Lip region offset 63
Lip region continuous 64

63. Spear 21-23 μ; tail 2.8 anal body-widths long ..... *bogdanovikatjkovi* (Kirjanova, 1941) Loof, 1959
Spear 23-27 μ; tail about 4 anal body-widths long ..... *leptus* Allen, 1955

64. Spear more than 24 μ 65
Spear less than 18 μ 68

65. Head sclerotization conspicuous; spear 30--42 μ 66
Head sclerotization inconspicuous; spear 24--27 μ 67

66. Body 0.8-1.1 mm; tail striae 39-47 .... *macrurus* (Goodey, 1932) Filipjev, 1936
Body 1.4-2.0 mm; tail striae 50-59 .... *icarus* Wallace & Greet, 1964

67. Body 0.6-0.8 mm; labial annules 7; tail striae 53-58 ..... *obscurus* Allen, 1955
Body 0.89-0.92 mm; labial annules 5-6; tail striae 35-39 ..... *socialis* Andrássy, 1962

68. Spear 12-15 μ; tail 3.8 anal body-widths long ..... *nanus* Allen, 1955
Spear 16-18 μ; tail about 3 anal body-widths long ..... *nothus* Allen, 1955

69. Lip region offset 70
Lip region continuous 77

70. Spear 67 μ; tail 1.3 anal body-widths long .. .. *superbus* Allen, 1955
Spear less than 48 μ; tail more than 2 anal body-widths long 71

71. Spear more than 39 μ 72
Spear less than 30 μ 74

72. Labial annules 7; tail 2.6 anal body-widths long; tail striae 34-37 .. *macrodens* Allen, 1955
Labial annules 9; tail 3.5-3.7 anal body-widths long; tail striae 49-58 73

73. Head sclerotization conspicuous; tail subcylindrical ..... *alpinus* Allen, 1955
Head sclerotization inconspicuous; tail conical ..... *conicus* Allen, 1955

74. Spear 25-30 μ 75
Spear 15-22 μ 76

75. Head sclerotization conspicuous; tail conical .. .. *grandis* Allen, 1955
Head sclerotization inconspicuous; tail subcylindrical ..... *lineatus* Allen, 1955

76. Spear 22 μ; tail 4 anal body-widths long .... *obscurisulcatus* Andrássy, 1959
Spear 15 μ; tail 2.5-3.0 anal body-widths long ..... *microdorus* Geraert, 1966

77. Tail 1.0-1.5 anal body-widths long; tail striae 10-12 ..... *brachycephalus* Litvinova, 1946
Tail more than 2 anal body-widths long; tail striae more than 20 78

78. Spear 14-16 μ ..... *brevidens* Allen, 1955
Spear 20-36 μ 79

79. Spear 20-22 μ 80
Spear more than 26 μ 81

80. Fourth annule of lip region divided into tiny blocks; tail striae about 20 .... *varians* Thorne & Malek, 1968
Fourth annule of lip region not divided into blocks; tail striae 49 .. *bavaricus* Sturhan, 1966

81. Labial annules 8; spear 26-28 μ; tail striae 28-33 ..... *affinis* Allen, 1955
Labial annules 5-7; spear 28-36 μ; tail striae 39-52 82

82. Head sclerotization conspicuous; hemizonid prominent ..... *hexagrammus* Sturhan, 1966
Head sclerotization inconspicuous; hemizonid not seen .... *berberidis* Sethi & Swarup, 1968

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African Species of the Genus *Belondira* Thorne, 1939

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African Species of the Genus *Belondira* Thorne, 1939

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ABSTRACT: Three species from Mauritius, *Belondira clavicaudata* (Williams, 1958) Andrássy, 1964, *B. perplexa* Williams, 1958, and *B. singularis* Williams, 1958, are redescribed from type specimens; their taxonomic position is discussed. *Belondira mernyi* Andrássy, 1970, and *B. tumicauda* sp. n. from the Congo are described. An amended diagnosis of the genus is given.

The genus *Belondira* appears to be rather poorly represented in Africa. Four species were recorded previously, three of these were found in Mauritius and a fourth in the Ivory Coast. The latter species was also found in the Congo together with a new species which is described herein. The species from Mauritius show some unusual characters; two of them even have been excluded from the genus *Belondira* in some recent studies. A critical study of the type specimens of the Mauritian species has revealed some new facts, therefore a redescription is given and the position of the species discussed. The specimens from the Congo were fixed with 4% formalin and mounted in glycerin.

Belondira perplexa Williams, 1958
(Fig. 1)

Measurements: See Table 1.

Females: Body slightly curved ventrally in death position, almost cylindrical except for anterior neck region which tapers rapidly. Cuticle marked with fine transverse striae. Lateral chords about 1/6–1/5 of body width near middle of body.

Lip region subtruncate, continuous with body; with prominent sclerotization and amalgamated lips. Amphids funnel-shaped (Fig. 1B) or with more convex sides; curved slitlike apertures occupying 3/4 of corresponding body width. Odontostyle 1.0–1.1 lip region widths long; its aperture about 2/7 of odontostyle length. Guiding ring 1.1–1.3 lip region widths from anterior end. Odontophore 1.1–1.4 times the odontostyle length.

Basal expanded part of esophagus occupying 33–37% of neck region, enveloped by a sheath of dextral (n = 3, Fig. 1J) or sinistral (n = 5, Fig. 1K) spiral muscle bands. Only the dorsal esophageal gland nucleus (DN) and outlet (DO) well visible, occurring at 66.5–68% (DO) and 68–69.6% (DN) of the neck length. Nerve ring surrounding anterior slender part of esophagus at 45–48% of neck length. Cardia cylindroid with rounded tip. Prerectum 4–5 and rectum about one anal body width(s) long.

Table 1. Measurements and diagnostic features of African *Belondira* species (females).

Species	*B. perplexa*		*B. singularis*		*B. clavicaudata*		*B. tumicauda*		
Locality	Magenta, Mauritius		Melrose, Mauritius		Union Park, Mauritius		Vieux Kilo, Congo		Nioka, Congo
No. of specimens	Holotype ♀	Paratype ♀♀ (7)	Holotype ♀	Paratype ♀♀ (2)	Holotype ♀	Paratype ♀♀ (4)	Holotype ♀	Paratype ♀	Paratype ♀♀ (2)
L (mm)	1.86	1.78–2.20	1.16	1.16–1.20	0.82	0.79–0.90	1.08	0.92	1.02–1.04
a	47	49–54	46	43–44	33	32–36	43	38	44–46
b	7.3	6.8–8.2	5.7	5.8–6.0	4.0	4.4–4.8	5.1	4.6	4.2–4.8
c	18	19–31	8.7	8.6–9.7	33	32–45	21.5	21	21–22
V	31	28–31	34	30–35	35.5	31–37	39.5	40.5	40–41
G1 (%)	1.8	1.3–2.4	3.7	3.1–3.2	2.5	1.9–2.7	2.7	3.4	2.6 (n = 1)
G2 (%)	21	11–26	16.4	12–14	15	10–18	24.5	14	29 (n = 1)
Cuticle thickness midbody (μ)	3	2–3	2	2	1.5	1.5	1	1	1
Lateral body pores—total number	25 R*	19–25 L, 21–24 R	?	18 L, ? R	?	17–18	?	?	?
—in neck region	4	4–5 L, 4–5 R	5 L	5–6 L, 6–7 R	?	4–5	?	?	?
—between cardia and anus	18	14–18 L, 15–19 R	?	9–10 L, ?R	?	10–11	?	?	?
—caudal pores	3	1–3 L, 1–3 R	7 (L + R)	6–7 (L + R)	2	2	2	2	2
Ventral body pores	13	14–16	?	10	?	?	?	?	?
L.r.w. = Lip region width (μ)	8	7.5–8	5.5	5.5	6	5.5–6	5	5	5.5–6
L.r.w./lip region height	2.0	1.8–2.3	1.8	1.8–2.2	2.0	1.5–2.0	1.7	2.0	1.9–2.0
Amphid width (μ)	?	4	3	?	3	3–4	?	3	3
Sensillae behind amphid aperture (μ)	?	16–19	?	16	?	22–23	22	23	?
Odontostyle length (μ)	9	7.5–9	6	5.5–6.5	3.5	3.5	3.5	3	3.5
Odontophore length (μ)	10	9–11	8	8.5–9.5	14	15	9	8.5	8–9
Guide ring from anterior end (μ)	–	6–9.5	5	5	4.5	5	6	5	5.5
Esophagus—total length (μ)	250	248–257	201	192–204	207	181–190	210	210	220–246
—length posterior part (μ)	88	88–93	66	64–75	112	82–92	87	84	95–109
Prerectum (Pr.) length (μ)	122	102–116	66	64–80	76	61–102	53	?	53 (n = 1)
Pr. anal body width	4.6	4.3–4.8	3.7	3.3–4.1	4.2	3.5–5.5	3.1	?	3.0 (n = 1)
Rectum length (μ)	29	26–31	20	?	?	20	12	13	15 (n = 1)
Tail length (μ)	104	60–106	133	120–140	25	20–25	50	43	46–50
Tail anal body width	3.9	2.5–4.1	7.5	6–7.2	1.4	1.1–1.4	2.9	2.3	2.6–3.0
Nerve ring from anterior end (μ)	119	113–122	91	85–87	59	68–69	82	87	90
Hemizonid from anterior end (μ)	118	110–117	86	80–83	?	62–63	?	?	?
Egg length by width (μ)	134 × 32	162 × 31 (n = 1)	–	–	–	–	157 × 20	–	–

* L = left, R = right body side.

Vulva transverse oval, 11 by 6 μ in one paratype. Vagina extending inward over more than half of the corresponding body width. Anterior gonad rudimentary, 1.8 times the corresponding body width long or less. Posterior gonad normal; uterus 1.5–2 body widths long. No sperm present in the gonads.

Tail convex–conoid in its anterior part, then tapering towards a rounded, sometimes slightly clavate tip; with two caudal pores on each side. Terminal nonprotoplasmic portion of tail 7–29 μ long.

MALE: Unknown.

JUVENILE: A single juvenile of the fourth stage was present among the paratypes. It agrees with the females in general morphology.

TYPE LOCALITY AND HABITAT: Soil around roots of sugar cane, Magenta, Mauritius.

Belondira singularis Williams, 1958
(Fig. 2)

MEASUREMENTS: See Table 1.

FEMALES: Body nearly straight or slightly curved ventrally in death position, tapering towards both extremities. Cuticle marked with transverse striae. Lateral chords about ⅕ of body width near middle of body. In one paratype several lateral body pores are surrounded by a jellylike substance to which fine particles adhere (Fig. 2L, M).

Lip region continuous with body, subtruncate; with amalgamated lips and internal sclerotization. Shape of amphids not clear; curved slitlike apertures occupying about half of the corresponding body width. Odontostyle 1.0–1.2 lip region widths long; its aperture about ⅓ of odontostyle length. Guiding ring about one lip region width from anterior end. Odontophore 1.3–1.7 times the odontostyle length.

Basal expanded portion of esophagus occupying 33–37% of the neck region, enveloped by a sheath of dextral spiral muscle bands. Dorsal gland nucleus situated at 68–72% of neck length. Nerve ring surrounding anterior slender part of esophagus at 42–45% of neck length. Cardia tongue-shaped, about half of the corresponding body width long. Prerectum 3–4 and rectum about one anal body width(s) long.

Vulva transverse oval, 10 by 4 μ in one paratype. Vagina extending inward over more than half of the body width. Anterior gonad rudimentary, 1.4–1.9 times as long as the corresponding body width. Posterior gonad normally developed; uterus 1.6–1.7 body widths long. Oval sperm present in prevulval sac or in oviduct of posterior gonad.

Tail with cylindroid proximal, clavate median, and filiform distal parts. The median expansion is due to expanded middle layers of the cuticle; the internal cuticle shows a pattern of spirally arranged fibers. Caudal pores arranged in two sets, one consisting of two to three pores in the vicinity of the anus, the other consisting of four pores just in front of the clavate swelling; two of the latter pores are lateral, one is ventral, and one dorsal.

MALE: Not found.

TYPE LOCALITY AND HABITAT: Soil around roots of sugar cane, Melrose, Mauritius.

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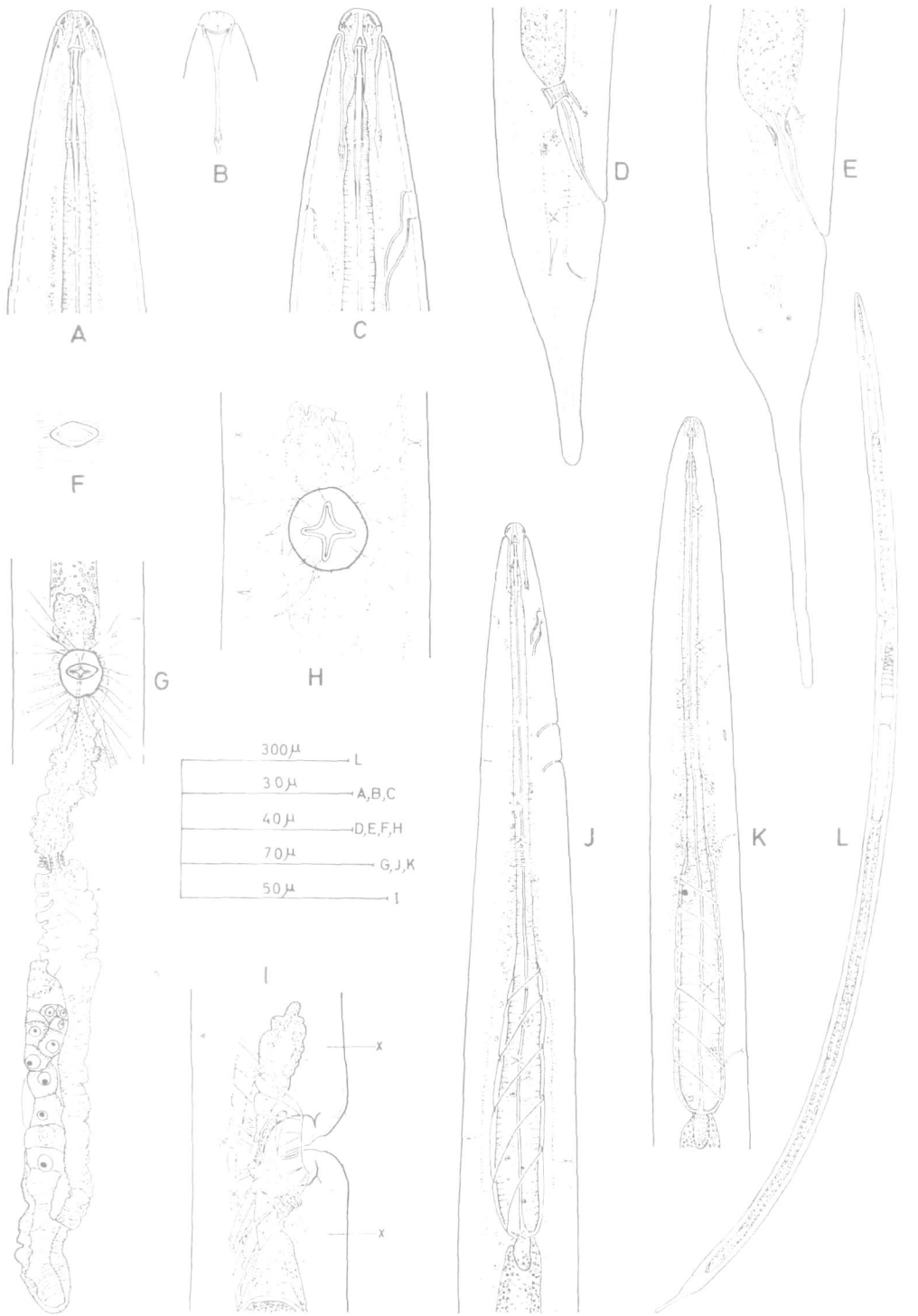
Figure 1. ***Belondira perplexa*** **Williams, 1958. A. Anterior end in lateral view. B. Surface view of the same. C. Anterior end in dorsoventral view. D, E. Variation in tail shape. F. Vulva in ventral view. G. Female gonads. H. Vagina in ventral view. I. Vulval region in lateral view. J. Neck region of specimen with dextral spiral muscle sheath. K. Neck region of specimen with sinistral spiral muscle sheath. L. Female. (Figs. E and I after holotype.) X, gap below cuticle.**

Figure 2. ***Belondira singularis*** **Williams, 1958. A. Anterior end in dorsoventral view. B. Anterior end in lateral view. C, D. Variation in tail shape. E. Neck region. F. Female gonads. G, Vulva in ventral view. H. Vagina in ventral view. I. Vulval region in lateral view. J. Female gonads. K. Posterior body region. L, M. Lateral body pores with secreted(?) substance. N, O. Female. (Figs. B, C, E, I, K, N, and O after holotype.)**

Figure 3. ***Belondira clavicaudata*** **(Williams, 1958). A. Female. B, C. Neck region. D–F. Anterior end. G. Esophagointestinal junction. H. Female gonads. I. Vulval region in lateral view. J. Vulva in ventrolateral view (specimen flattened). K. Posterior region, lateral. L. Posterior region, ventral. M. Tail in surface view. N. Tail. (Figs. F, I, and M after holotype.) Arrow indicates position of anus.**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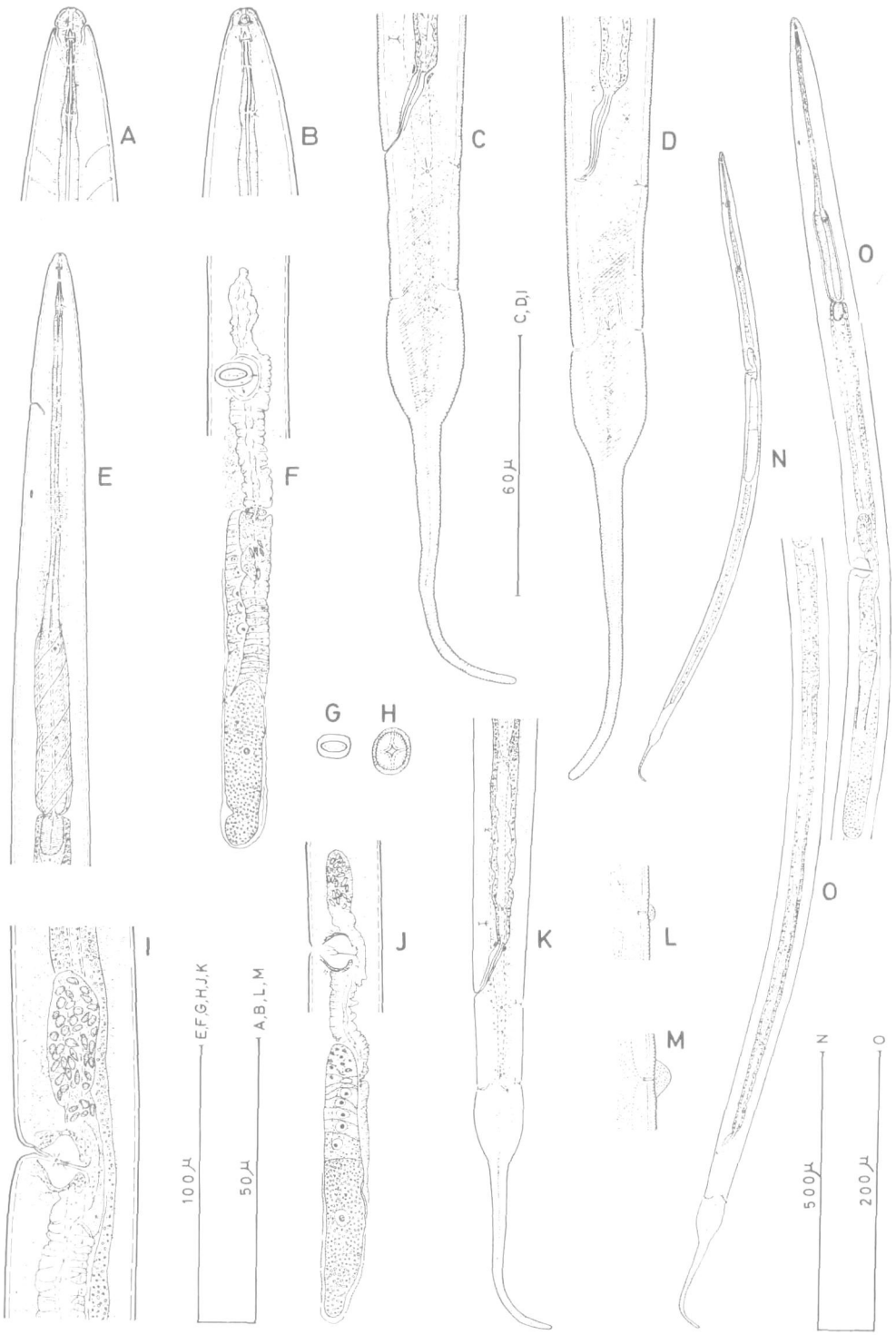
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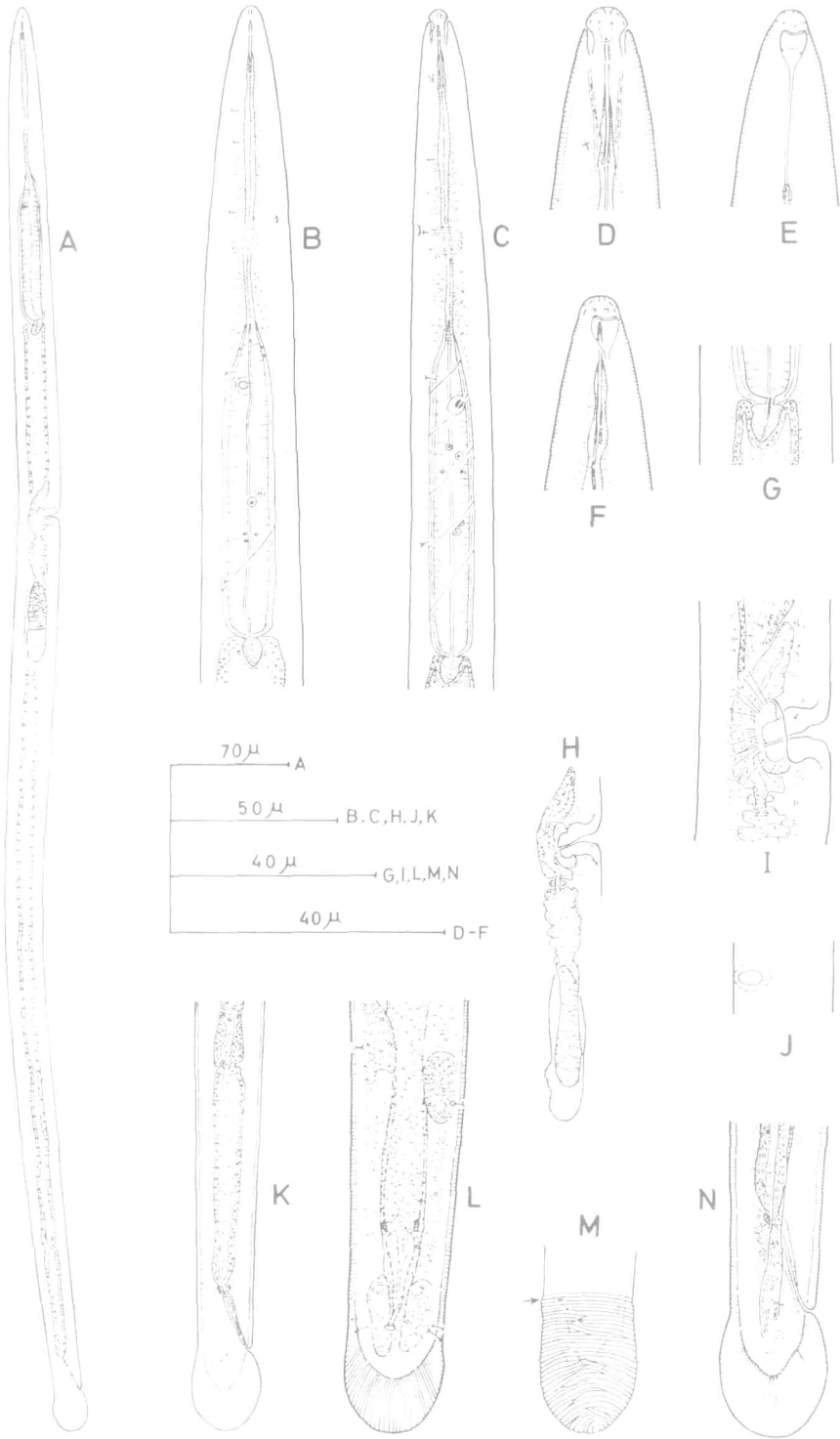
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D-F

Belondira clavicaudata (Williams, 1958) Andrássy, 1964
(Fig. 3)

MEASUREMENTS: See Table 1.

FEMALES: Body nearly straight in death position, tapering gradually but slowly toward both ends (except for expanded tail). Cuticle thickest on tail; transversely striated throughout the body length, but more prominently so in anterior and posterior regions. Lateral chords about ⅕ of body width near middle of body.

Lip region rounded to subtruncate, marked by very slight depression from body; with amalgamated lips and weakly developed sclerotization. Base of lip region about ¼ as wide as neck base. Amphid apertures curved, ⅜–⅔ of corresponding body width, leading to deep pouches. Odontostyle very short, slightly more than half the lip region width long; aperture about ⅓ of odontostyle length. Guiding ring 0.9 times the lip region width from anterior end. Odontophore 4–4.3 times the odontostyle length.

Basal expanded portion of esophagus occupying 45–54% of neck region, enveloped by a sheath of dextral spiral muscle bands. Dorsal esophageal gland nucleus at 54–64% of neck region. Nerve ring surrounding slender part of esophagus at 29–38% of neck length. Cardia heart-shaped. Prerectum 3.5–5.5 and rectum 1.2 anal body widths long.

Vulva transverse oval, 7.5 by 4.5 μ in one paratype. Vagina extending about halfway into the body, slightly bent posteriorly. Anterior gonad rudimentary, about one body width long. Posterior gonad normally developed, with very short uterus (about ½ body width long). Sperm not observed in any part of the gonads.

Tail clavate due to an expansion of the outer cuticular layers; with two caudal pores on each side. Terminal nonprotoplasmic portion 13–15 μ.

MALE: Unknown.

TYPE LOCALITY AND HABITAT: Soil around roots of sugar cane, Union Park, Mauritius.

OTHER LOCALITY AND HABITAT: Moss from rocks near motorway between Santos and São Paulo, Brazil (cf. Andrássy, 1963).

Belondira tumicauda sp. n.
(Fig. 4)

MEASUREMENTS: See Table 1.

FEMALES: Body curved ventrally upon fixation, J- or even C-shaped; tapering gradually toward both ends (except for expanded tail). Cuticle finely striated transversely; more prominently striated in the caudal region. Outer cuticular layers extremely thickened on tail. Lateral chords about ¼ of body width at midbody; somewhat irregular in outline due to the occurrence of granular lateral organs.

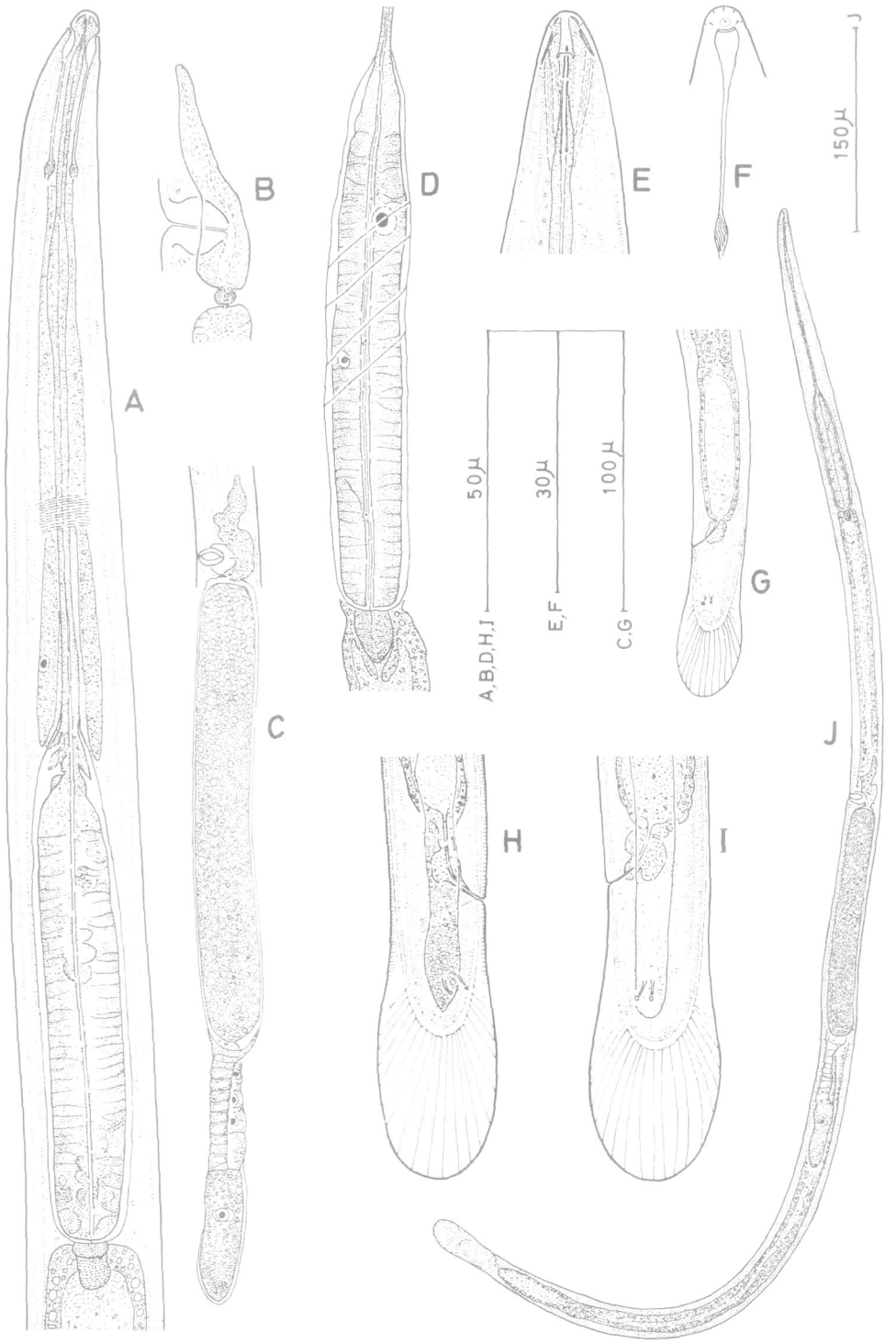
Lip region rounded to subtruncate, continuous with body contour, with prominent sclerotization. Base of lip region about ¼ as wide as neck base. Lips amalgamated, bearing the usual number of papillae. Amphid apertures slightly curved, ½ to ⅗ of the corresponding body width, leading to deep pouches. Odontostyle very short, ½–⅔ of the lip region width long, aperture about 1 μ long. Guiding ring about one lip region width from anterior end. Odontophore 2.3–2.8 times the odontostyle length.

Basal expanded portion of esophagus occupying 41–44% of neck region, enveloped by a weakly developed sheath of dextral spiral muscle bands. Dorsal esophageal gland nucleus at 71% ($n = 1$) of neck region. Nerve ring surrounding slender part of esophagus at 39–43% of neck length. Cardia tongue-shaped. Prerectum about 3 times the anal body width. Rectum length about equal to anal body width.

Vulva transverse oval, 7 by 3 μ in holotype. Vagina extending halfway into body. Anterior gonad rudimentary, 29–33 μ long, i.e., 1.2–1.4 times the corresponding body width. Posterior gonad normally developed, with very short uterus (less than ½ body width long!). Size of posterior gonad variable according to presence and size of oocytes which were from 92–301 μ in specimens studied. Gonads with

→

Figure 4. ***Belondira tumicauda*** **sp. n. A. Neck region. B. Vulval region. C. Female gonads. D. Expanded part of esophagus. E. Anterior end. F. Surface view of the same. G. Posterior region. H, I. Variation in tail shape. J. Female. (Figs. A, C, G, I, and J after holotype.)**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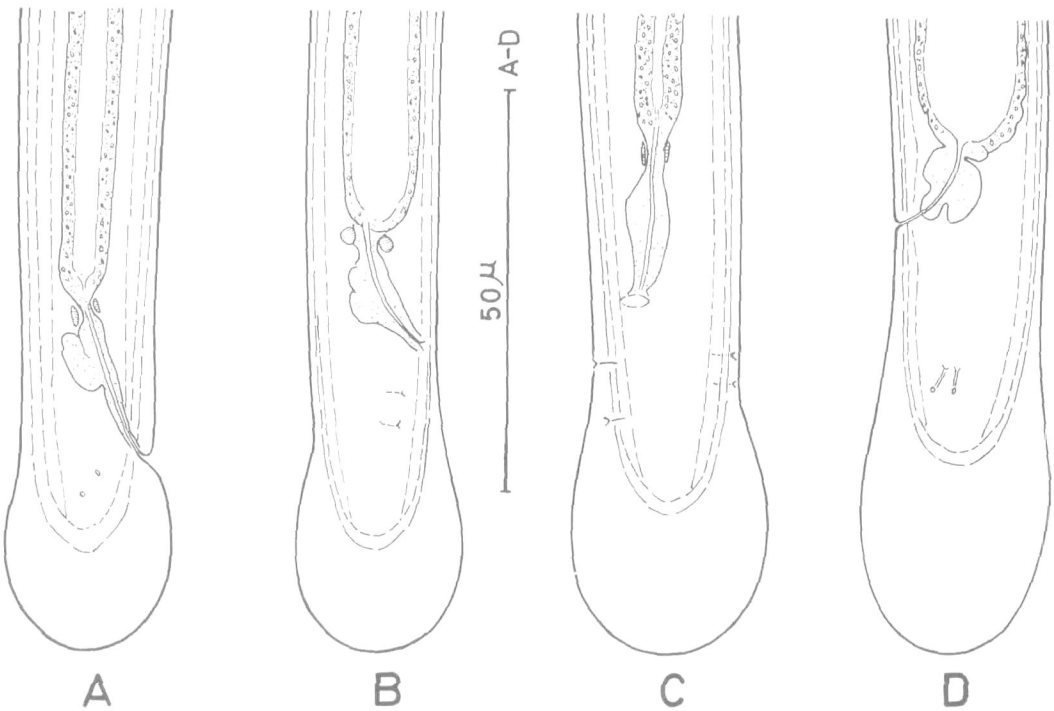

Figure 5. ***Belondira*** **species, tails. A.** ***B. clavicaudata*****, paratype female. B.** ***B. bulbosa*****, paratype juvenile. C.** ***B. bulbosa*****, holotype. D.** ***B. tumicauda*****, holotype.**

several large oocytes in the ovary, reflexed up to two body widths anterior to vulva. No sperm seen in gonads.

Tail clavate, due to expansion of outer radially striated cuticular layers, and with two caudal pores on each side. Nonprotoplasmic terminal portion of tail 23–27 μ.

MALE: Unknown.

JUVENILES: Four juveniles were found, agreeing with the females in general morphology.

TYPE LOCALITY AND HABITAT: Vieux Kilo, Ituri, the Congo. Clay soil from a tea plantation. Collected by A. Coomans on 13 November 1959.

OTHER LOCALITY AND HABITAT: Nioka, Ituri, Congo. Soil around roots of *Ageratum conizoides* Reichb. in a coffee plantation.

TYPE MATERIAL: Holotype female and one paratype juvenile on slide n° 32, Nematode Collection of Instituut voor Dierkunde, Rijksuniversiteit Gent. Three paratype females and two paratype juveniles deposited in same collection.

RELATIONSHIP: *Belondira tumicauda* sp. n. is closely related to *B. bulbosa* Siddiqi, 1966, but differs mainly in the absence of males, shorter prevulval sac (2.3 times body width in *B. bulbosa*), and body posture when dead (almost straight in *B. bulbosa*). Possibly also by the shorter uterus of the posterior gonad (about one body width in *B. bulbosa*), shorter odontostyle (4.5 μ in *B. bulbosa*), slightly different position of vulva (V = 43 in *B. bulbosa*), and thicker cuticular tail tip (about as wide as anal body width in *B. bulbosa*). Further studies on intraspecific variation in this group are necessary to evaluate some of the above mentioned differences. The new species resembles also *B. clavicaudata* from which it differs in the slightly longer but relatively narrower body, more posterior vulva, longer and differently shaped tail (see Table 1). Figure 5 gives outline drawings of tails from these three closely related species.

Finally *B. tumicauda* also resembles *B. parva* Thorne, 1964, but differs by the same char-

acters as from *B. clavicaudata*, and by the absence of males.

The specific name refers to the peculiar shape of the tail (*tumidus* = swelling, *cauda* = tail).

Belondira mernyi Andrássy, 1970

This species was described from the Ivory Coast from a female and male specimen. Two males and three juveniles of the species were found at the type locality of *B. tumicauda*.

♂♂: L = 1.27–1.28 mm; a = 51–58; b = 6.0–6.3; c = 26–29. Odontostyle 3.5 μ.

Body almost straight in death position. Lip region 6.5–7 μ wide and 4 μ high, more rounded than in Andrássy's specimens. Sensillae 28 μ behind amphid aperture. Guiding ring some 7 μ from anterior extremity. Neck region 203–213 μ long, 35–38.5% of it occupied by expanded portion of esophagus. Tail 44–50 μ long, i.e., 2.2–2.7 times the anal body width. Terminal nonprotoplasmic part 11–15 μ thick, expanded by inner and outer cuticular layers. Only two caudal pores seen, instead of three as illustrated by Andrássy (1970). Supplements an adanal pair and a ventromedian at about $\frac{2}{3}$ of spicula length from cloacal opening. Andrássy (loc. cit.) reported a single ventromedian supplement but situated at about two spicula lengths from the cloacal opening. In our specimens there also occurs a papillalike structure at this level but it does not differ from the ventral body pores that occur more anteriorly, hence it can be equally well considered as the last element of the ventral body pore series. Otherwise our specimens agree well with the original description.

Juveniles agree with females in general morphology.

Discussion

The resdescription of the Mauritian *Belondira* species was necessary in order to ascertain their position since two of the species were excluded from the genus by Jairajpuri (1964), Siddiqi (1966), and Andrássy (1970). Jairajpuri considered *B. perplexa* and *B. singularis* as nearer to *Oxydirus* and possibly belonging to a new genus. Siddiqi did not include both species in his key to species of *Belondira*. Andrássy (loc. cit., p. 247) listed only two *Belondira* species from Africa and did not consider *B. perplexa* and *B. singularis* as true *Belondira*'s.

The present study reveals that both species possess all the typical characters of the genus except for the tail shape. However, tail shape seems very variable and also very exceptional, as illustrated by the species described in the present paper. Although the tail shape of *B. perplexa* reminds that of some *Oxydirus* species, the other characters do not correspond to that genus. The tail shape and structure of *B. singularis* are not comparable to those in *Oxydirus*. The finding of long-tailed species of a genus previously known only to contain short-tailed ones is not exceptional, e.g., *Xiphinema*, *Dorylaimellus*.

In the light of the facts and conclusions presented here, an emended diagnosis of the genus may be given:

Belondira Thorne, 1939

Diagnosis (after Thorne, 1964, emended): Belondirinae. Small to medium-sized nematodes (0.7 to 2.5 mm). Lip region rounded to truncated, papillae not projecting. Outer parts of head framework weakly to moderately sclerotized, appearing refractive in profile. Anterior part of esophagus not set off by constriction; posterior part surrounded by a sheath of usually dextral, rarely sinistral muscle bands. Anterior gonad rudimentary, saclike. Posterior gonad normally developed. Supplements consisting of an adanal pair and one or 2 ventromedian ones; when two, they are widely separated. Tail short and bluntly rounded to clavate, cylindrical, or elongated, usually with thickened cuticle.

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THE STATUS OF *AXONCHIUM CAUDATUM* WILLIAMS, 1958 WITH SOME OBSERVATIONS ON THE JUVENILES OF *AXONCHIUM AMPLICOLLE* COBB, 1920

BY

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The second-stage juveniles of *Axonchium amplicolle* Cobb, 1920 have convex-conoid to elongate tails and are similar morphologically to *Axonchium caudatum* Williams, 1958. Since the description of *A. caudatum* is based on juveniles (second-stage) it is regarded as *species inquirenda*. Observations on the second-,third- and fourth-stage juveniles and the adult females of *A. amplicolle* are also recorded in the present study.

Williams (1958) described a species of *Axonchium* Cobb, 1920 viz., *A. caudatum* from Mauritius based on juveniles. The species was considered unique in the genus because of its tail shape which was convex-conoid to elongate, about 3 anal body-widths long with a swollen terminus. The tails of all the other known species of this genus are short, rounded to conoid and only about one anal body-width long. Williams (*l.c.*) made repeated attempts to collect mature specimens but without success. Jairajpuri (1965) also obtained immature specimens of *Axonchium* from Waltair, Visakhapatnam, India and classified them as *A. caudatum* since they conformed fully with the description of the species by Williams. Thorne (1964) and Hechler (1969) made useful contributions to our knowledge of *Axonchium*. Thorne (*l.c.*) described a new species, *A. arcuatum* which has a slightly aberrant tail, viz., convex-conoid to a blunt, subdigitate terminus, about one and a half anal body widths long, the tail of the younger specimens being even longer than the mature ones. Hechler (*l.c.*) regarded *A. caudatum* as valid since she has included it in the key to the species of the genus *Axonchium*.

A large number of specimens of *A amplicolle* Cobb, 1920 were sent to the senior author by Mr. Peter L. Mathias who collected them from the soil around the roots of Kennedy Ruzi grass from the Grand Anse Research Station, Seychelles in the year 1969. These specimens contain mature females as well as juveniles. On the basis of their morphology, the immature specimens were sorted out into the second-, third- and fourth-stage juveniles. The study of the

second-stage juveniles proved to be interesting because they conform fully with the observations of Williams (*l.c.*) on *A. caudatum* and the specimens of this species recorded by Jairajpuri (*l.c.*) in India. All the specimens of second-stage juveniles in the above collection have convex-conoid to elongate tails about 3 to 4 anal body-widths long with a distinct clavate terminus. The anterior 40% of the tail is convex-conoid, marked off from the rest of the tail by a constriction (such a constriction is also evident from Williams' illustration of the tail of *A. caudatum*) ;

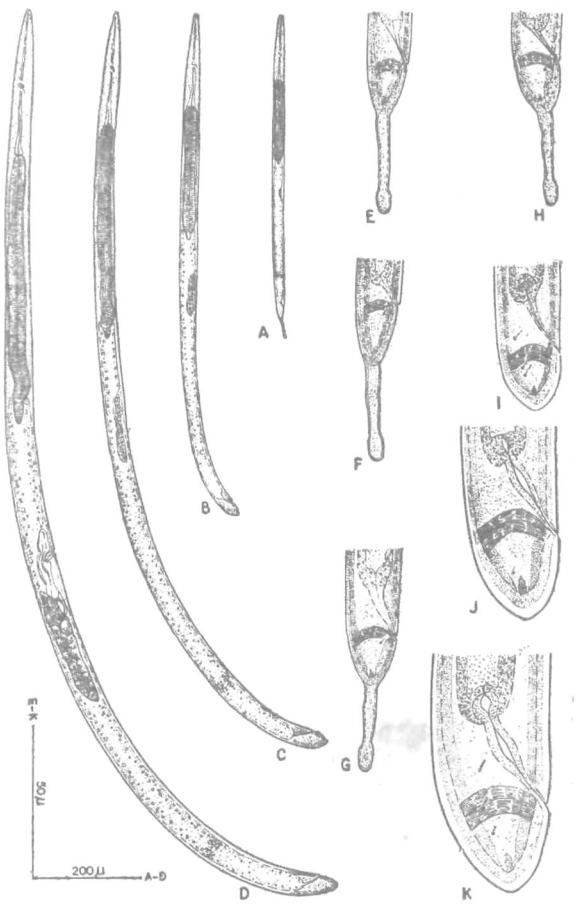

Fig. 1 : A-K. *Axonchium amplicolle.* A = Second-stage juvenile, B = Third-stage juvenile, C = Fourth-stage juvenile, D = Adult female, E-H = tails of second-stage juvenile, I = tail of third-stage juvenile, J = tail of fourth-stage juvenile, K = tail of adult female.

the rest of the tail is elongate with swollen tip. The core of the tail does not extend beyond the first part of the tail. The tails of the third and fourth stages as well as of the adult are typical convex-conoid about one anal body-width long (Fig. 1).

A brief description and measurements of the adult and juveniles of *A. amplicolle* from Seychelles are recorded below :—

Dimensions of Axonchium amplicolle

	L (mm)	a	b	c	V
Second Stage (4 juveniles)	0.60–0.64	34–40	2.0–2.2	12–16	—
Third Stage (9 juveniles)	0.78–0.96	31–36	1.9–2.3	28–40	—
Fourth Stage (3 juveniles)	0.98–1.46	39–50	2.3–2.6	45–63	—
Adult (15 females)	1.63–2.10	36–42	2.1–2.7	72–84	50–60

Second-Stage Juvenile : Body almost straight. Lip region well marked off. Spear 5-6 μ long. Esophagus about half the total body length. The genital primordium 13-22 μ long, a compact mass of 4 cells. Intestine-prerectum junction faint ; prerectum 58-87 μ long. Tail convex-conoid in anterior 40% of its length, then digitate with clavate terminus, 46-55 μ or 3 to 4 anal body-widths long.

Third-Stage Juvenile : Body almost straight, except at posterior extremity where it is slightly ventrally arcuate. Spear 7 μ long. The genital primordium 30-73 μ long, consists of a compact mass of cells. Prerectum 95-120 μ long. Tail short, convex-conoid without the digit-like process which is perhaps lost during the second molt ; 21-29 μ or slightly more than one anal body-width long.

Fourth-Stage Juvenile : Body slightly ventrally arcuate in posterior third of its length. Spear 8-9 μ long. The genital primordium in advanced stage of development, 102-164 μ long. Prerectum 136-160 μ long. Tail short, convex-conoid, 22-23 μ long or slightly shorter than the anal body-width.

Adult (*Female*) *:* Body slightly ventrally arcuate posterior to esophagus. Lip region well marked off from the body. Spear 11-12 μ long. Gonad mono-opisthodelphic. Anterior uterine sac 22-25 μ, less than one vulval body-width long. Posterior sexual branch 248-332 μ. Prerectum 190-215 μ long. Tail 23-29 μ long, or slightly less than one anal body-width.

DISCUSSION

The present observations on *Axonchium amplicolle* indicate that in all probability the species of the genus *Axonchium* possess convex-conoid to elongate tails with clavate tip during their development as second-stage juveniles. As this

stage moults into the third-stage juvenile, the posterior elongate part of the tail is lost and what remains is only the anterior convex-conoid part which persists till the adult stage, the only known exception being *A. arcuatum* Thorne, 1964 where a slightly subdigitate terminus persists up to the adult stage, although smaller than the juveniles (Thorne, 1964).

Williams (*l.c.*) proposed the new species *A. caudatum*, perhaps on the assumption that the adults of this species would also possess almost the same type of tail. On the basis of our observations we feel that this may perhaps not be the case and what Williams described as *A. caudatum* was the second-stage juvenile of an *Axonchium* species which will have normal tail type in the adult stage. It is, however, not possible to ascertain specific differences at the second stage of development in the species of *Axonchium*. It may just be possible that *A. caudatum* is the second-stage juvenile of *A. mauritiense* Williams, 1958 since both were recorded from Cent Gaulettes, Mauritius (*A. mauritiense* collected on 23.9.1957 and *A. caudatum* on 29.10.1957). Under the circumstances it appears most appropriate to regard *A. caudatum* Williams, 1958 and also specimens of *Axonchium* designated as *A. caudatum* by Jairajpuri (1965) as *species inquirendae*.

We are thankful to Mr. Peter L. Mathias for sending the specimens of *Axonchium amplicolle* and to Professor S. Mashhood Alam, Head, Department of Zoology, Aligarh Muslim University for providing the necessary laboratory facilities.

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NEMATODES OF HIGH ALTITUDES IN INDIA
I. FOUR NEW SPECIES OF TYLENCHIDA

BY

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Hoplolaimus chambus n. sp., 1.24-1.62 mm long, lateral fields marked by breaks in body striations, head marked with 3 annules, basal annule of lip region with 6 longitudinal striae, spear 41-45 μ, oesophageal glands with 6 nuclei, intestine overlapping rectum, and males unknown. A key to species of *Hoplolaimus* is also given. *Rotylenchus indorobustus* n. sp., 0.90-1.02 mm long, head marked with 7-8 annules, basal annule of lip region with 24 longitudinal striae, spear 32-35 μ, phasmids pre-anal, and males unkown. *Helicotylenchus rohtangus* n. sp., 0.89-1.12 mm long, head marked with 5-6 annules, spear 36-38 μ, tail with irregularly indented terminus, phasmids pre-anal, and males unknown. *Hemicycliophora subaolica* n. sp., females 1.04-1.08 mm long, body annules 225-245, longitudinal lines and incisures absent, head with 2 annules, spear 89-99 μ, tail uniformly conoid, and males recorded.

During the years 1970 and 1971 a survey of some parts of Himalaya in Himachal Pradesh, India was conducted and over 100 soil samples were collected from various localities at different altitudes. The analyses of these samples showed a wide variety of tylenchid, dorylaimid, mononchid and other soil-inhabiting nematodes. A few of the species encountered were recorded earlier from the plains in India, but the majority of them are entirely different. Many of the forms represent new species which incidentally show close resemblance to species recorded from temperate zones of the world. It is proposed to publish the findings of these expeditions in a series of papers which will cover all nematode groups. In this first paper four new species of Tylenchida are described.

The nematodes were fixed in hot 4% formalin, dehydrated slowly in a desiccator and mounted in anhydrous glycerine. Many specimens of *Rotylenchus indorobustus* showed shrinkage during dehydration by this technique. All such specimens were transferred to melted glycerine-jelly and within a few minutes the shrinkage disappeared. Such specimens were also mounted in the melted glycerine-jelly and were found to show excellent details of cuticular structures as well as gonads. Type material has been labelled and deposited with the Zoology Department, Aligarh Muslim University. The following paratypes have been deposited with the Department of Nematology, Landbouwhogeschool, Wageningen, The Netherlands: *Hoplolaimus chambus* 2 ♀♀, *Rotylenchus indorobustus* 1 ♀, *Helicotylenchus rohtangus* 1 ♀ and *Hemicycliophora subaolica* 1 ♀.

HOPLOLAIMUS CHAMBUS N. SP.
(Fig. 1)

Dimensions

Paratype females (14): L = 1.40 mm (1.24-1.62 mm); a = 31 (28-35); b = 9. 8 (8.4-11.0); b′ = 8.1 (7.0-9.1); c = 58 (52-67); V = 55 (52-56); O = 12-14.

Holotype female: L = 1.48 mm; a = 32; b = 10.8; b′ = 8.5; c =62; V = 56; O = 12.

Description

Body almost straight, slightly ventrally arcuate or 'C' shaped when fixed, tapering anterior to oesophageal-intestinal junction. Transverse striae 2-3 μ apart. Lateral field marked only by breaks in striae.

Head distinctly set off from body, conical, marked with 3 annules. Head framework typical. Basal annule of lip region marked with 6 longitudinal lines, dividing it into two big subdorsal, two subventral, and two small lateral lobes (3 *en face* views). Spear 43 μ (41-45 μ), robust; its anterior part (metenchium) 22-24 μ or 53-56% of spear length. Base of spear with three distinct anteriorly pointed indented knobs (each knob with 3 identations at its anterior margin), 7-8 μ wide. Oesophagus typical. Median bulb 22-24 × 15-18 μ, at 53-56% of the total oesophageal length from anterior extremity. Oesophageal glands with six distinct nuclei. Orifice of dorsal oesophageal gland 5-6 μ from base of spear. Oesophago-intestinal valve (cardia) well developed, collar-like. Intestine overlaps rectum up to level of anus. Excretory pore in the region of the nerve ring or slightly below the oesophago-intestinal junction or anywhere between these two positions. Hemizonid 6-11 annules below excretory pore, 2-3 annules wide. Hemizonion 9-15 annules below hemizonid. Anterior pair of cephalids 2-3 annules below lip region. Posterior pair of cephalids not seen. Anterior scutellum 29-33% of body length from anterior end, posterior 79-84%. Nerve ring 112-139 μ from anterior end.

Gonads typical. Spermatheca non-functional, without sperms. Oocytes arranged in single row, sometimes in double rows. Epitygma single, attached posteriorly. Tail rounded with 9-13 annules.

Males: Unknown.

Habitat: Soil around roots of banana (*Musa paradisiaca*) and sugarcane (*Saccharum officinarum*) from near Chamba bridge (altitude 4,000 feet), district Chamba, H.P.

Type specimens: Collected by the authors in October, 1971; holotype mounted on slide H.A.97/*Hoplolaimus chambus*/1; paratypes on slides H.A.97/*Hoplolaimus chambus*/2-7.

Differential diagnosis: *Hoplolaimus chambus* n. sp. comes close to *H. columbus* Sher, 1963 and *H. seinhorsti* Luc, 1958. From the former it can be distinguished

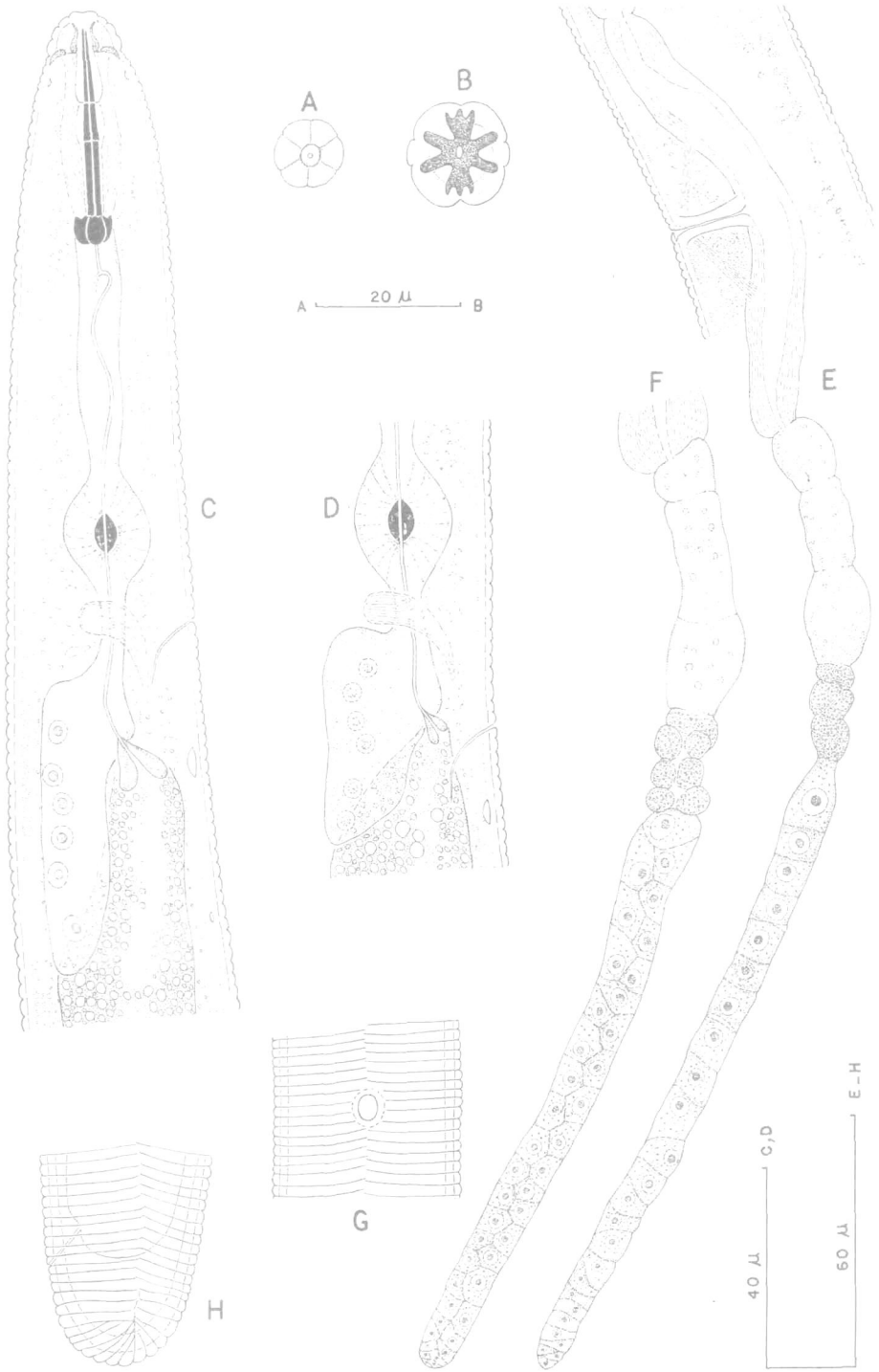

Fig. 1. *Hoplolaimus chambus* n. sp. A- *En face* view; B- Cross section through basal annule of lip region; C- Oesophageal region; D- Posterior oesophageal region showing variations in the shape of basal glandular lobe, and positions of excretory pore and hemizonid; E- Vulva region and posterior gonad; F- Ovary with double rows of oocytes; G- Surface view at anterior scutellum region; H- Tail.

in having a differently shaped head, basal annule of lip region marked with 6 longitudinal lines (10-15 longitudinal lines in *H. columbus),* hemizonid and excretory pore separated by 6-11 annules (2 annules in *H. columbus*) and a pronounced oesophago-intestinal valve (cardia). From *H. seinhorsti* it differs in having a differently shaped head, 6 longitudinal lines on the basal annule of the lip region (8-12 longitudinal lines in *H. seinhorsti*), differently shaped spear knobs (knobs with only two indentations in *H. seinhorsti*) and intestine overlapping rectum up to level of anus.

Remarks: Our study of *Hoplolaimus chambus* and the other two new species of Hoplolaiminae described in this paper clearly reveals that the distance between the excretory pore and hemizonid is not very consistent within a particular species and thus is not a reliable character. Similarly, the position of excretory pore and hemizonid in relation to the oesophago-intestinal junction is also very variable and thus is of little taxonomic importance. Sher (1963, 1965, 1966) laid considerable emphasis on these characters.

KEY TO SPECIES OF HOPLOLAIMUS

1. Bisexual, spermatheca functional 2
   Monosexual, spermatheca non-functional 11
2. Oesophageal gland lobe with 6 nuclei . . . . . *indicus* Sher, 1963
   Oesophageal gland lobe with 3 nuclei 3
3. Body marked with 4 incisures; excretory pore below hemizonid 4
   Body marked with less than 4 incisures; excretory pore above hemizonid 9
4. Both scutella located below centre of body . . . . . *californicus* Sher, 1963
   Anterior scutellum pre-vulval and the posterior post-vulval 5
5. Spear 35 μ or less, basal knobs with less developed anterior projections . . . . . *aorolaimoides* Siddiqi, 1972
   Spear 39 μ or more, basal knobs with pronounced anterior projections 6
6. Lip region with 3 or 4 annules; female tail usually bluntly rounded . . . . . *tylenchiformis* Daday, 1905
   Lip region with 4 or more annules; female tail usually rounded 7
7. Lip region with 24-28 longitudinal lines on basal annule; spicules 30-38 μ long . . . . . *stephanus* Sher, 1963
   Lip region with 32-36 longitudinal lines on basal annule; spicules 40-56 μ long . . 8
8. Spear knobs anteriorly dentate 'tulip-shaped'; tails of first and second stage juveniles conically pointed with an acute terminus . . . . . *concaudajuvencus* Golden & Minton, 1970
   Spear knobs less projected anteriorly; tails of first and second stage juveniles rounded . . . . . *galeatus* (Cobb, 1913) Thorne, 1935
9. Intestine overlapping rectum . *pararobustus* (Sch. Stekh. & Teunissen, 1938) Sher, 1963
   Intestine not overlapping rectum 10
10. Body marked with or without a single lateral line . . . *casparus* Berg & Heyns, 1970
    Body marked with two lateral lines . . . . . *capensis* Berg & Heyns, 1970
11. Both scutella pre-vulval . . . . . *puertoricensis* Ramirez, 1964
    Anterior scutellum pre-vulval and posterior post-vulval 12
12. Intestine overlapping rectum. 13
    Intestine not overlapping rectum 14
13. Basal annule of lip region marked with 6 longitudinal lines . . . *chambus* n. sp.
    Basal anule of lip region marked with 10-15 longitudinal lines . *columbus* Sher, 1963
14. Body marked with or without a single lateral line; basal annule of lip region marked with 8-12 longitudinal lines . . . . . *seinhorsti* Luc, 1958
    Body marked with two lateral lines; basal annule of lip region marked with 20 longitudinal lines . . . . . *Sheri* Suryawanshi, 1971

Species inquirenda: *Hoplolaimus steineri* Kannan, 1961 because of very poor description.

ROTYLENCHUS INDOROBUSTUS N. SP.

(Fig. 2)

Dimensions

Female paratypes (19): L = 0.97 mm (0.90-1.02 mm); a = 23 (18-28); b = 7.0 (6.7-7.2); b′ = 6.1 (5.6-6.4); c = 60 (55-63); V = 54 (53-56); O = 19-22.

Female holotype: L = 0.86; a = 23; b = 6.6; b′ = 5.8; c = 58; V = 55; O = 19.

Description

Body spirally curved when fixed, tapering gradually anterior to oesophago-intestinal junction. Transverse striae about 1 μ apart on body. Lateral fields marked with 4 incisures, about 1/6th of body-width near middle, areolated only anteriorly in the oesophageal region.

Head marked with a slight depression, hemispherical, flat at apex, consisting of 7-8 annules. Head frame-work typical. Basal annule of lip region marked with 24 longitudinal striae (2 *en face* views). Spear 33 μ (32-35 μ); anterior part (metenchium) 15-17 μ or 47-50% of spear length. Spear knobs anteriorly pointed, 5-6 μ wide. Oesophagus typical. Orifice of dorsal oesophageal gland 6-7 μ from base of spear. Excretory pore slightly above or below the oesophago-intestinal junction, 131-141 μ from anterior extremity. Hemizonid 1-2 annules wide, usually situated just above the excretory pore or on the same annule. Hemizonion 11-18 annules posterior to hemizonid. Anterior pair of cephalids 3-4 annules posterior to lip region, posterior pair of cephalids 5-8 annules posterior to anterior cephalids. Nerve ring 107-119 μ from anterior end.

Gonads typical. A sphincter-like structure is present between the uterus and oviduct and some special muscles (perhaps sphincter muscles) also encircle the collumellate part of the uteri. Oviduct muscular. Spermatheca not developed. Oocytes arranged in a single row. Epiptygma single, attached anteriorly or posteriorly. Tail tapering with more dorsal curvature, terminus hemispherical or slightly conical, 15-18 μ or about 1/2-3/4 of anal body-width long, 10-14 annules ventrally. Phasmids 1-5 annules above the anus.

Males: Unknown.

Habitat: Soil around roots of ferns and grasses (unidentified) from Subash Baoli (altitude 6,678 feet), Dalhousie, district Chamba, H.P.

Type specimens: Collected by the authors in October, 1971; holotype along with one paratype mounted on slide H.A.100/*Rotylenchus indorobustus*/1; paratypes mounted on H.A.100/*Rotylenchus indorobustus*/2-6.

Differential diagnosis: *Rotylenchus indorobustus* n. sp. comes close to *R. fallorobustus* Sher, 1965 but differs mainly in the shape of the spear knobs, and in having the basal annule of the lip region marked with 24 longitudinal lines (only 4-8 longitudinal lines in *R. fallorobustus*).

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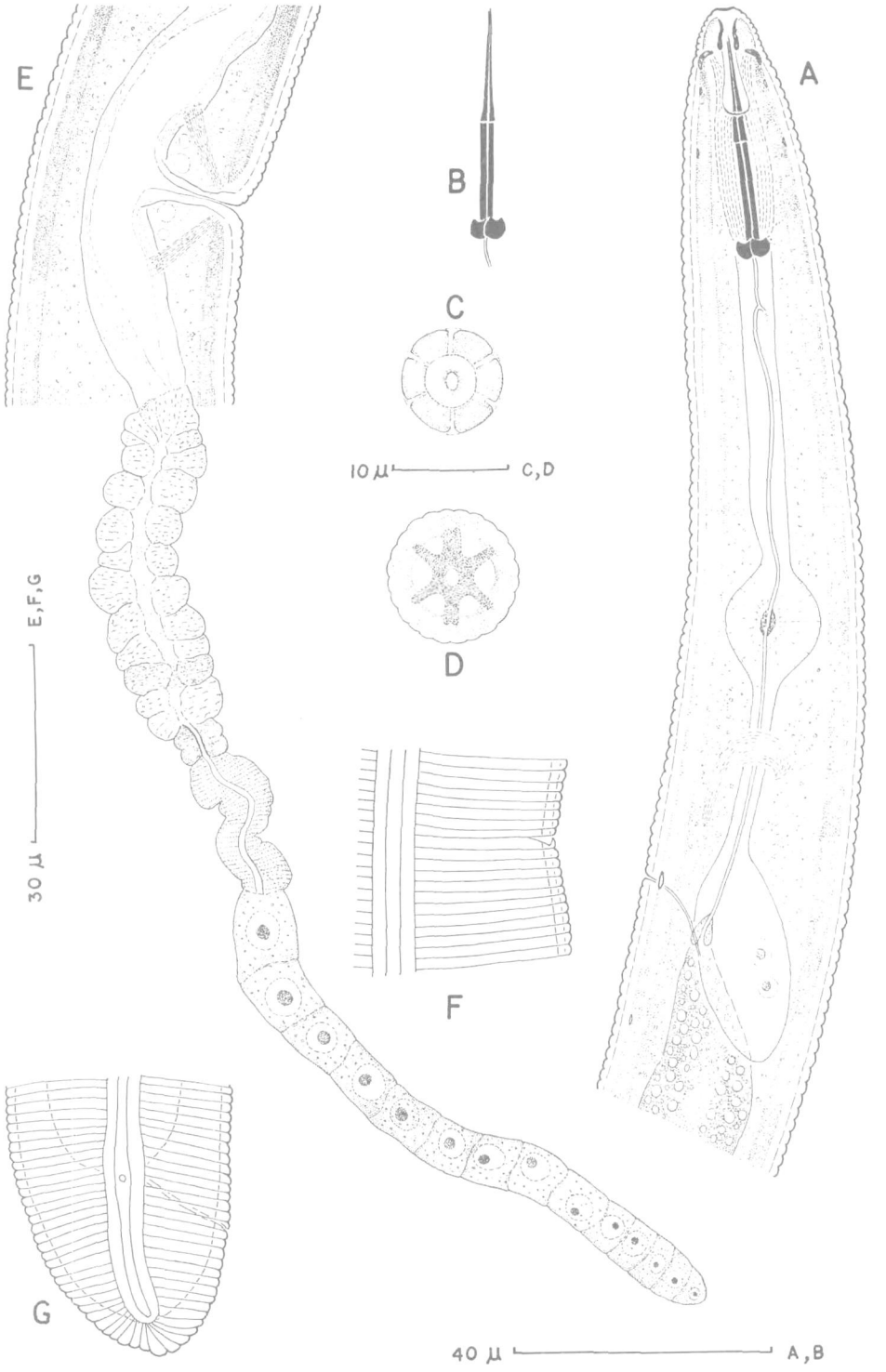

Fig. 2. *Rotylenchus indorobustus* n. sp. A- Oesophageal region; B- Spear; C- *En face* view; D- Cross section through basal annule of lip region; E- Vulva region and posterior gonad; F- Vulva region showing cuticular pattern; G- Tail.

HELICOTYLENCHUS ROHTANGUS N. SP.
(Fig. 3)

Dimensions

Female paratypes (16): L = 1.00 mm (0.89-1.12 mm); a = 33 (30-37); b = 6.1 (5.8-6.9); b′ = 5.0 (4.5-5.5); c = 34 (28-44); V = 63.5 (61-67); O = 30-39.

Female holotype: L = 0.99 mm; a = 32; b = 5.7; b′ = 4.8; c = 34; V = 66; O = 36.

Description

Body twice or more spirally curved when fixed, tapering gradually towards both extremities, but more markedly anterior to basal oesophageal lobe. Transverse striae about 1 μ apart on body. Lateral fields marked with 4 incisures, 1/3.5-1/4 of body-width near middle.

Head almost continuous with body, marked with 5-6 annules. Head framework typical. Spear 37 μ (36-38 μ); anterior part (metenchium) 17-19 μ or 46-50% of spear length. Spear knobs anteriorly pointed, 5-6 μ wide. Oesophagus typical. Orifice of dorsal oesophageal gland 11-14 μ from base of spear. The position of excretory pore varies from base of isthmus to middle of glandular lobes. Hemizonid 1-4 annules above the excretory pore. Cephalids at base of metenchium. Nerve ring 115-149 μ from anterior extremity.

Gonads typical. Spermatheca non-functional. Oocytes usually arranged in a single row except at anterior end. Tail cylindrical, slightly ventrally curved with an irregularly indented terminus (very rarely with flat terminus), 22-38 μ or about 1.2-1.9 anal body-widths long, 16-30 annules ventrally. Phasmids 1-12 annules above the anus.

Males: Unknown.

Habitat: Soil around roots of grasses (unidentified) from Rohtang Pass (altitude approx. 14,000 ft), district Kulu, H.P.

Type specimens: Collected by first author in October, 1970; holotype mounted on slide H.A.5/*Helicotylenchus rohtangus*/1; paratypes mounted on slides H.A. 5/*Helicotylenchus rohtangus*/2-7.

Differential diagnosis: *Helicotylenchus rohtangus* n. sp. comes clost to *H. platyurus* Perry in Perry, Darling & Thorne, 1959 and *H. spitsbergensis* Loof, 1971. From the former it differs in having longer spear (28-32 μ in *H. platyurus*), anteriorly pointed basal knobs (rounded, flattened or slightly anteriorly indented in *H. platyurus*), and differently shaped tail (more curved dorsally with hemispherical terminus in *H. platyurus*). From *H. spitsbergensis* it can be distinguished in having a differently shaped head, longer spear (27-31 μ in *H. spitsbergensis*), more posterior position of dorsal oesophageal gland orifice (8-9 μ in *H. spitsbergensis*), and in having a more ventrally curved tail.

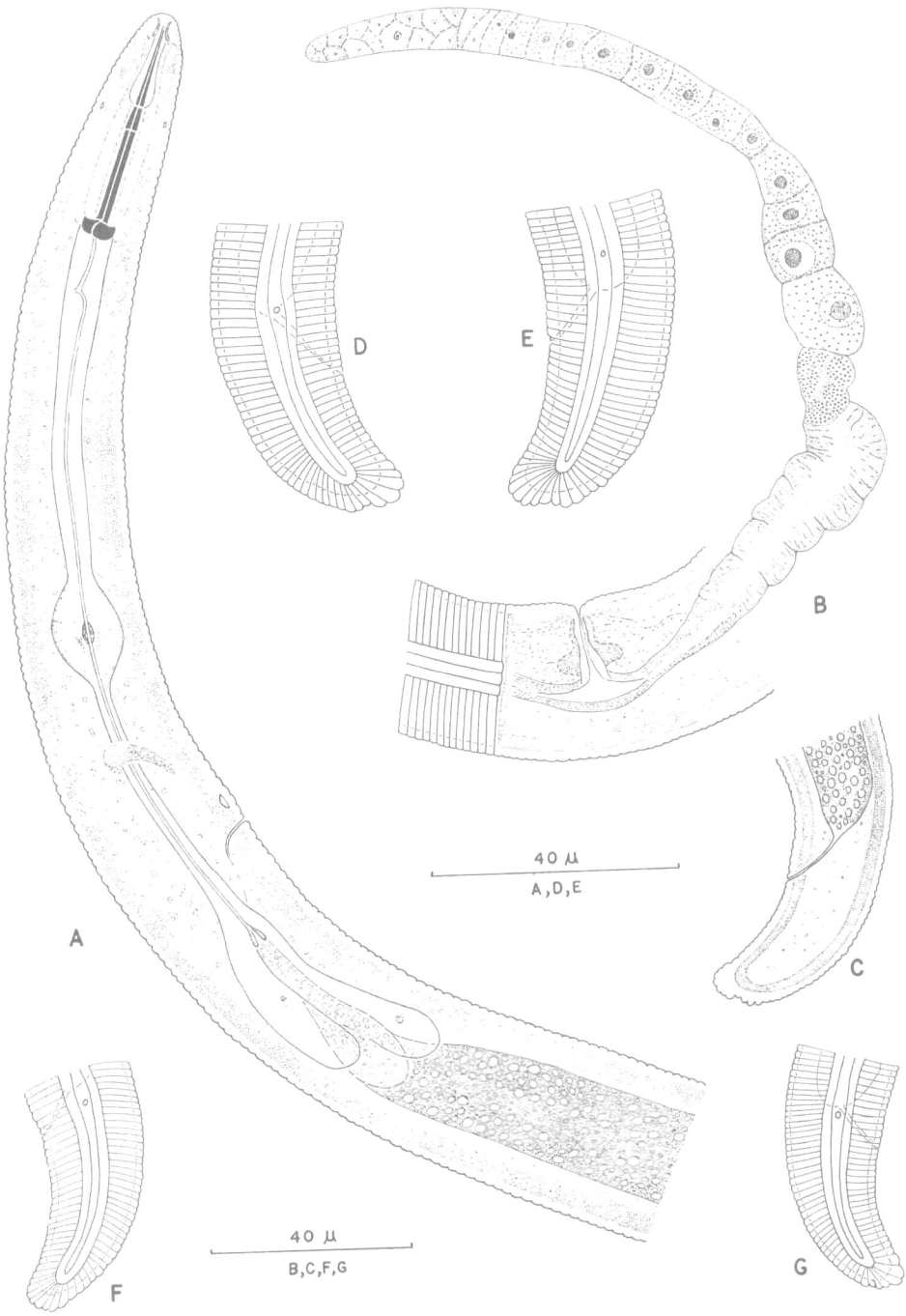

Fig. 3. *Helicotylenchus rohtangus* n. sp. A- Oesophageal region; B- Anterior gonad and surface view posterior to vulva; C-G- Tails.

HEMICYLIOPHORA SUBAOLICA N. SP.

(Fig. 4)

Dimensions

Female paratypes (8): L = 1.07 mm (1.04-1.08 mm); a = 23 (18-29); b = 6.2 (6.0-6.7); c = 12?; V = 84 (83-85).

Female holotype: L = 1.08 mm; a = 27; b = 6.1; c = ?; V = 84.

Male paratypes (3): L = 0.76-0.80 mm; a = 31-32; b = 5.0-5.5; c = 6.6-8.0; T = 20-28.

Description

Body almost straight, rarely slightly curved dorsally or ventrally, tapering anterior to median bulb of oesophagus. Cuticle typical; marked with 225-245 annules of which 35-43 are in the oesophageal region, 144-162 from base of oesophagus to vulva and 37-47 from vulva to tail terminus; annules 4-5 μ apart. Longitudinal lines and incisures absent.

Head continuous with body, bearing two annules, labial disc elevated. Spear 94 μ (89-99 μ) long, 8.5-9.2% of body length, occupying 19-24 annules; its anterior part (metenchium) 75-84 μ or 81-85% of spear length. Basal knobs of spear rounded, directed backward, 7-8 μ wide. Oesophagus typical. Median bulb 37-45 × 16-20 μ with well developed crescentic valve. Orifice of dorsal oesophageal gland 5-7 μ from base of spear. Excretory pore below the oesophago-intestinal junction on 38-46 body annules or 180-196 μ from anterior extremity. Hemizonid 1-4 annules above the excretory pore, 1-2 annules wide. Nerve ring encircles almost the whole isthmus.

Vulva with protruding lips and a ventral contraction behind. Vulval terminus distance 3.2-5.0 times the vulval body-width and 1.7-2.0 times the spear length. Gonad mono-prodelphic. Spermatheca spherical, filled with sperms. Oocytes arranged in single row except at anterior end. Tail uniformly conoid. Anus obscure, observed in only one specimen, 10 annules posterior to vulva.

Dimensions of aberrant female:

L = 1.38 mm; a = 32; b = 6.6; c = ?; V = 85; Spear 102 μ; body annules = 341.

This single female is unique among those studied in having a longer body, longer spear and a large number of body annules, otherwise it is very similar to other females of the population.

Males: Body very slender, showing marked sexual dimorphism, slightly curved ventrally. Cuticle finely striated, 1.5-2.0 μ apart.

Head almost continuous with body, smooth, rounded in shape. Spear and oesophagus degenerated. Excretory pore above the oesophago-intestinal junction, 133-140 μ from anterior extremity. Hemizonid 3-4 annules above the excretory pore. Bursa narrow. Spicules curved, 47-50 μ along medial axis. Gubernaculum

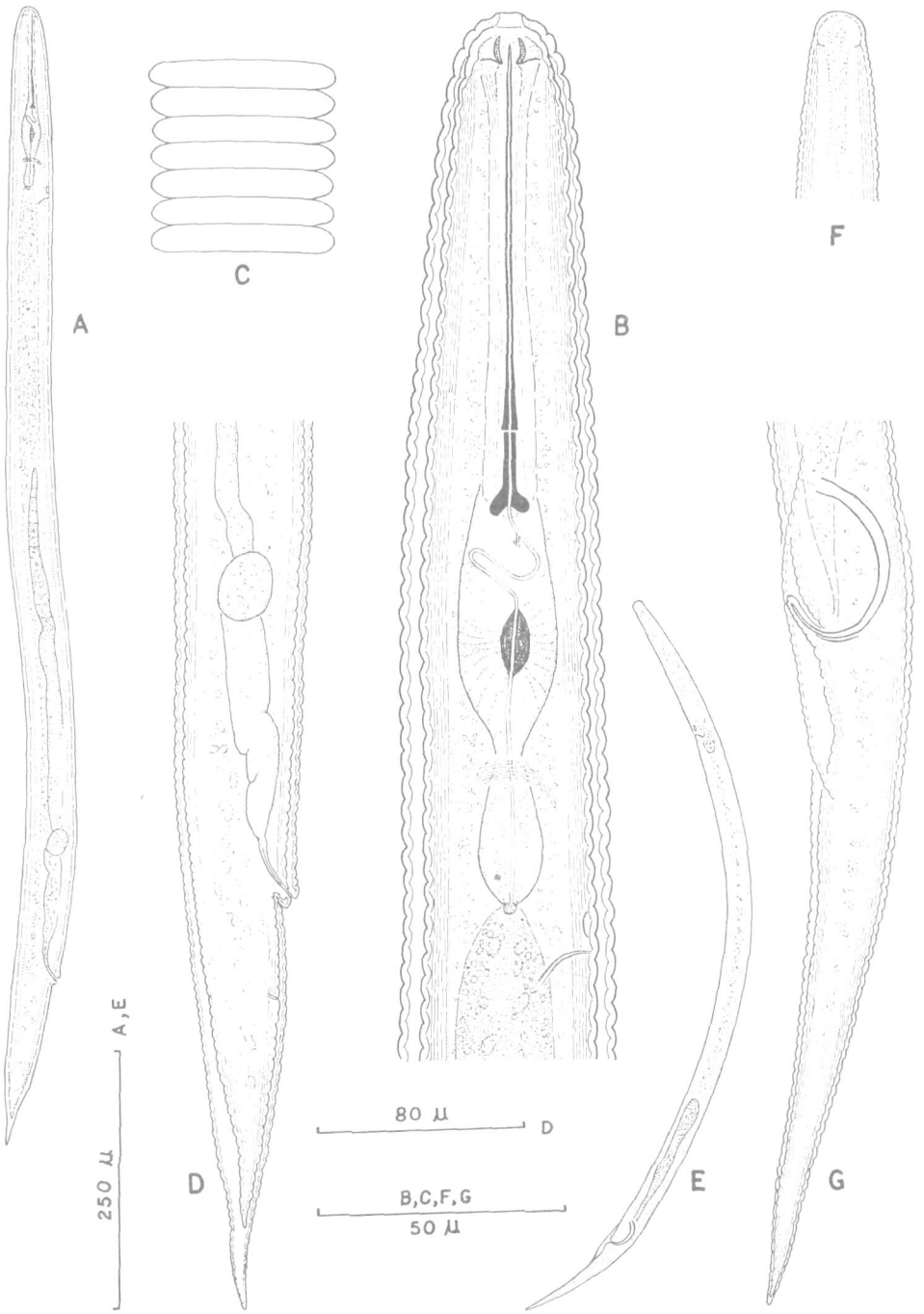

Fig. 4. *Hemicycliophora subaolica* n. sp. A-D- Female: A- Entire female; B- Anterior region; C- Surface view near middle of body; D- Posterior region. E-G- Male: E- Entire male; F- Head end; G- Tail.

9-10 μ long. Tail elongate-conoid, 113-138 μ or about 5-6 anal body-widths long.

Habitat: Soil around roots of ferns and grasses (unidentified) from Subhash Baoli (altitude 6,678 feet), Dalhousie, district Chamba, H. P.

Type specimens: Collected by the authors in October, 1971; holotype female mounted on slide H.A.100/*Hemicycliophora subaolica*/1; paratype females and males on slides H.A.100/*Hemicycliophora subaolica*/2-6.

Differential diagnosis: *Hemicycliophora subaolica* n. sp. is unique in the genus *Hemicycliophora* in having smooth body annules, i.e., without lateral lines, breaks or interruptions. It is somewhat close to *H. zuckermani* Brzeski, 1965 but the females differ from the latter species in having a differently shaped lip region, smooth body annules (annules interrupted on lateral fields in *H. zuckermani*), vulva with protruding lips and a ventral contraction behind vulva (vulva continuous with body contour in *H. zuckermani*). The males of *H. subaolica* differ from those of *H. zuckermani* (described by Brzeski & Zuckerman, 1965) in having head continuous with body (set off in *H. zuckermani*), shorter spicules (59 μ in *H. zuckermani*) and shorter tail (c = 4.8 in *H. zuckermani*).

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ZUSAMMENFASSUNG

Nematoden aus Hochgebirgslagen in Indien I: Vier neue Arten der Ordnung Tylenchida

Hoplolaimus chambus n. sp. ist 1,24-1,62 mm lang; Seitenfeld nur durch eine Unterbrechung der Körperringelung angedeutet; Lippenregion aus drei Ringen, der basale Ring mit 6 Längsfurchen; Mundstachel 41-45 μm lang; Ösophagusdrüsen mit 6 Kernen; Mitteldarm überlappt Rectum; Männchen unbekannt. Es wird ein Bestimmungsschlüssel für die Arten der Gattung *Hoplolaimus* mitgeteilt.

Rotylenchus indorobustus n. sp. ist 0,9-1,02 mm lang; Kopf mit 7-8 Ringen, davon Basalring mit 24 Längsfurchen; Mundstachel 32-35 μm lang; Phasmiden präanal; Männchen unbekannt.

Helicotylenchus rontangus n. sp. ist 0,89-1,12 mm lang; Kopf durch 5-6 Ringe gekennzeichnet; Mundstachel 36-38 μ lang; Schwanz mit unregelmäßig eingekerbter Spitze; Phasmiden präanal; Männchen unbekannt.

Die Weibchen von *Hemicycliophora subaolica* n. sp. sind 1,04-1,08 mm lang und besitzen 225-245 Körperringe; Längsstreifen und -einschnitte fehlen; Kopf mit 2 Ringen; Mundstachel 89-99 μm; Schwanz gleichmäßig kegelförmig; Männchen vorhanden.

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NEMATODES OF HIGH ALTITUDES IN INDIA. II. STUDIES ON THE GENUS *TRIDONTUS* KHERA, 1965 WITH NOTES ON THE SYNONYMY OF THE GENUS *SYEDELLA* SURYAWANSHI, 1971 (DIPLOGASTERIDAE) *

BY

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A diplogasterid nematode species collected at Chamba, H.P., during the survey of nematodes of high altitudes in India was identified as *Tridontus longicaudatus* Khera, 1965. The species, *Syedella aurangabadensis* Suryawanshi, 1971, and *Koerneria* sp. Heyns, 1971 are regarded as synonyms of *T. longicaudatus*, and the genus *Syedella* Suryawanshi, 1971 of *Tridontus* Khera, 1965. The specimens from Chamba are described in detail as certain morphological features of *T. longicaudatus* were inadequately reported. The diagnosis of the genus *Tridontus* is emended.

The survey of nematodes of high altitudes in India in October, 1971 yielded a number of specimens of a diplogasterid from the samples collected at Chamba (altitude 4,000 ft.), H.P., from soil around roots of banana and sugarcane. The nematodes are characterized by the prominent longitudinal ridges on the cuticle, heavily sclerotized dorsal metarhabdion with a large movable 'claw-like' tooth, and 'whip-like' tails. They come close to the genus *Tridontus* Khera, 1965. However, there are some obvious differences from the latter genus (as described by Khera) especially in the nature of dorsal metarhabdion which is said to be provided "with three large incurved hooklike teeth", and in having almost straight spicules. In the meantime, Heyns (1971) illustrated (but did not describe) a very similar nematode species but placed it under the genus *Koerneria* Meyl, 1960 as *Koerneria* sp., and Suryawanshi (1971) described an almost identical species and named it *Syedella aurangabadensis*.

This all has led to considerable confusion and since our species showed resemblance to the species described by Khera, by Heyns and by Suryawanshi, it was thought proper to study the material from these sources in order to confirm the identity of our specimens as well as to determine the interrelationship of the three genera, viz., *Tridontus*, *Koerneria* and *Syedella*. One possibility was immediately ruled out, this was the assigning of the species to *Koerneria* as was done by Heyns. In the latter genus the dorsal metarhabdion carries a tooth which is opposed by a similar one on the right subventral segment. In addition, the tail shape is far different in the species of *Koerneria*. Both these characters were absent

* This paper in a slightly modified form was read by the first author at the XIth International symposium of Nematology held at Reading University, England in September, 1972.

in *Koerneria* sp. of Heyns. Therefore the latter belonged either to *Tridontus* or to *Syedella*. The genus *Syedella* was found to be very much like the genus *Tridontus* except for the three large incurved hooklike teeth and the almost straight spicules in the latter. The study of the paratypes kindly loaned out by Dr. Khera showed that neither is there any difference in the structure of the stoma nor in the spicules (which were shown almost straight by Khera). A study of the material from Chamba and its comparison with other species mentioned above showed no differences and thus confirmed that they all belong to one and the same species and should be identified as *Tridontus longicaudatus* Khera, 1965, according to Law of Priority. The species, *Syedella aurangabadensis* Suryawanshi, 1971 and *Koerneria* sp. of Heyns, 1971 are regarded as synonyms of *T. longicaudatus* Khera, 1965 and the genus *Syedella* Suryawanshi, 1971 of *Tridontus* Khera, 1965. The description of this species is based on a few specimens only (6 ♀♀, 2 ♂♂ Khera; 2 ♀♀, 3 ♂♂ Suryawanshi; and 1 ♀, 1 ♂ Heyns which he only figured but did not describe) and is also inadequate with respect to some morphological characters. It is therefore proposed to redescribe the species and also to provide an emended diagnosis of *Tridontus*.

TRIDONTUS LONGICAUDATUS KHERA, 1965

(Fig. 1)

Syns: *Syedella aurangabadensis* Suryawanshi, 1971
Koerneria sp. Heyns, 1971

Dimensions: Table I.

TABLE I

Dimensions of Tridontus longicaudatus

n	L (mm)	a	b	c	V/T
After Khera (1965):					
6 ♀♀	1.10-1.40	21-28	6.2-7.2	2.3-2.5	34-38
2 ♂♂	0.92-0.94	26-28	6.2-6.4	2.6-2.7	35-38
After Suryawanshi (1971):					
2 ♀♀	0.80	27	5.9	2.3	36
3 ♂♂	0.64-0.72	26-32	5.6-6.6	2.5-2.9	29-33
Heyns specimens:					
1 ♀	1.08	29	7.3	2.1	31
1 ♀	0.82	32	6.2	2.7	34
Chamba specimens:					
	0.95	30	6.7	2.1	34
13 ♀♀	(0.81-1.12)	(23-37)	(6.2-7.8)	(2.0-2.4)	(29-39)
9 ♂♂	0.69-0.99	23-39	5.0-7.6	2.0-2.9	28-37

Description:

Female: Body, medium-sized, tapering slightly anteriorly but markedly posteriorly to a very long filiform tail. Cuticle very finely striated transversely and marked with longitudinal lines which are formed by the presence of longitudinal

cuticular ridges. The cuticular ridges arise at the base of the lip region, become more pronounced in the oesophageal region where their number is about 27, and near middle of body the number increases to about 30. The number decreases gradually posteriorly up to a short distance along the tail where they disappear completely. Due to the presence of these cuticular ridges, the longitudinal markings on the body appear to be arranged in pairs when viewed superficially. Lip region rounded, measuring 14-16 × 6-7 μ, slightly marked off from the body contour. Amphids small, depressed, inconspicuous laterally; dorso-ventrally they appear to open at base of lip region with small slit-like apertures. The *en face* view shows a circular mouth, 6 pairs of 'rugae' and 10 labial papillae distributed as follows: 4 pairs submedially and one each laterally. Lips inconspicuous, perhaps fused, their positions discernible by the rugae and the labial papillae. The rugae are elliptical and pointed posteriorly; their blunt ends project anteriorly surrounding the oral aperture. The projecting ends of the rugae are clearly visible laterally as well as dorso-ventrally in toto-mounts.

Stoma 16-20 μ long, 8-10 μ wide, divisible into a wide, strongly sclerotized anterior part and a comparatively narrower, longer and lightly sclerotized hinder part. The cheilorhabdions are undivided and often appear to protrude outside above the lip region. The pro- and mesorhabdions are strongly sclerotized. The dorsal metarhabdion is heavily sclerotized and provided with a claw-like tooth which has its apex directed anteriad and situated at 6-7 μ from anterior end of body. The tooth is hollow from the inside, movable, and appears to receive the duct from the dorsal oesophageal gland which opens in this region of the buccal cavity. The subventral walls opposite dorsal tooth bear a small, rose-thorn shaped tooth. The narrower hinder part of stoma also bears a small tooth at its base.

Oesophagus typically diplogasterid and surrounds stoma up to base of metarhabdion. The procorpus and the median bulb possess conspicuous radial musculature. The median bulb 16-21 μ long, 13-17 μ wide, almost confluent with procorpus but sharply demarcated from isthmus. The valvular plates are very distinct; a cross-section of the body in the region of the median bulb shows the valvular plates to be strongly sclerotized and conspicuously thickened. Isthmus narrow, enveloped by nerve ring, and gradually expanding to form the valveless end bulb which encloses the three (dorsal and 2 subventral) oesophageal glands. The ducts of the subventral oesophageal glands have their outlets in the lumen of the oesophagus at the base of the median bulb through discernible ampullae. The dorsal oesophageal gland duct passes through the length of the oesophagus and opens in the stoma at the level of the metarhabdion. Oesophageal lumen greatly thickened in regions of procorpus and median bulb, but very narrow as it passes through isthmus and end bulb. Intestine thin-walled with wide lumen. Rectum 20-27 μ long, longer than anal body-width. Anus a large circular opening. Nerve ring at 89-115 μ and excretory pore at 115-130 μ from anterior end of body.

Vulva a small pore-like opening bordered by 4 hyaline cuticular pieces. Vagina a flattened tube, nearly a half of the vulval body-width long. Four saccular glands,

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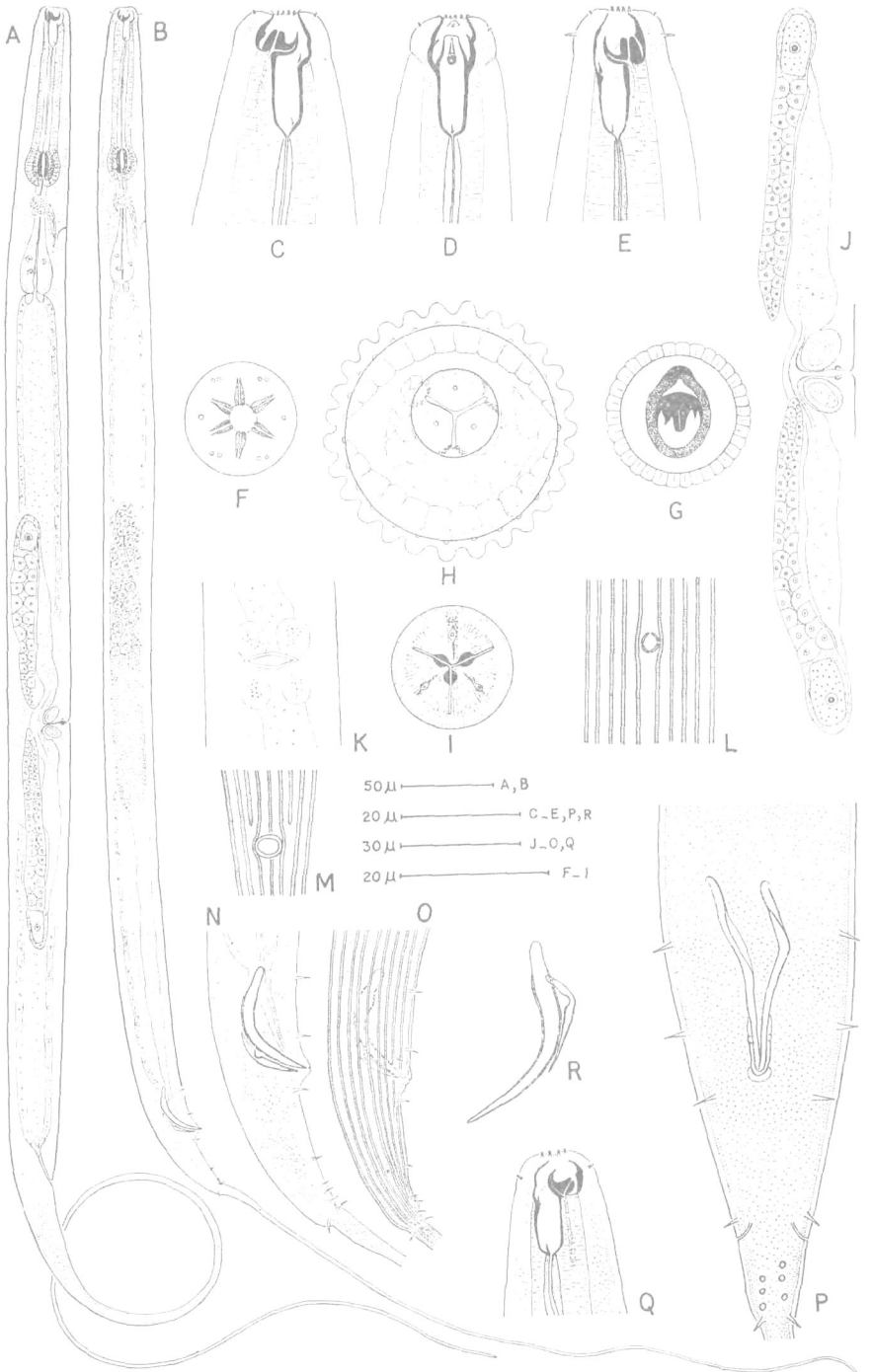

Fig. 1. *Tridontus longicaudatus* Khera, 1965: A — Female entire, B — Male entire, C — Head end female, lateral, D — Head end female, dorso-ventral, E — Head end male, F — *En face* view, G — T.S. of body at level of metarhabdion, H — T.S. of body at level of nerve ring, I — T.S. of median bulb, J — Female reproductive system, K — Vagina with saccular glands, L — Vulva and longitudinal cuticular ridges, M — Anus and longitudinal cuticular ridges, N — Male anal region, O — Male anal region superficial, lateral, P — Male anal region showing setose papillae, Q — Head end male (Khera specimens-paratype), R — Spicule and gubernaculum (Khera specimens-paratype).

each with a distinct cavity, join the vagina. Gonads amphidelphic, ovaries reflexed. Each sexual branch consists of an ovary reflexed almost to the vulva and having a large number of oocytes arranged in 2-3 rows. Oviduct at first narrow than widens and passes imperceptibly into uterus. Tail whip-like, 416-510 μ long.

Male: The six cephalic papillae of the outer circlet are setose. Testis reflexed at the tip. Spicules ventrally arcuate, 36-38 μ long, fused at their tips. Gubernaculum trough-shaped, 17-19 μ long, with a clear notch in the middle. The part of the gubernaculum anterior to the notch is weakly sclerotized or may even be inconspicuous in a few specimens. Caudal papillae 9 pairs distributed as follows: 2 pairs preanal, one adanal (not seen in dorso-ventral view), and 6 pairs postanal (the positions of these papillae are indicated in Fig. 1 N, O & P). Phasmids visible in both lateral and dorso-ventral view, situated immediately below the second pair of postanal papillae. Tail narrows abruptly behind last postanal pair of papillae.

Habitat: Soil around roots of banana and sugarcane from Mali-ka-Bagh near Chamba bridge, Dist. Chamba (altitude 4,000 ft.), Himachal Pradesh, India.

GENUS TRIDONTUS KHERA, 1965

syn. *Syedella* Suryawanshi, 1971

Diagnosis (emended): Diplogasterinae. Sexes alike with very long filiform whip-like tails. Cuticle provided with prominent ridges which appear as longitudinal lines in pairs. Lips inconspicuous, head flattened. Labial papillae visible, the outer circlet setose in males. Stoma composed of an anterior wider part and a posterior narrower and less sclerotized part. Dorsal metarhabdion bearing a hollow claw-like tooth. Female gonads amphidelphic, reflexed. Male gonad single, testis reflexed at tip. Gubernaculum trough-shaped. Bursa absent. Caudal papillae setose.

Type and only species: Tridontus longicaudatus Khera, 1965
syn. *Syedella aurangabadensis* Suryawanshi, 1971
Koerneria sp. Heyns, 1971

We are thankful to Drs. J. Heyns, S. Khera and M. V. Suryawanshi for their helpful suggestions and/or for providing the material for our study.

ZUSAMMENFASSUNG

Nematoden aus Hochgebirgslagen in Indien. Untersuchungen an der Gattung Tridontus *Khera, 1965 mit Bemerkungen zur Synonymisierung der Gattung* Syedella *Suryawanshi, 1971 (Diplogasteridae)*

Im Laufe der Untersuchung von Nematoden aus Hochgebirgslagen wurde in Chamba, H. P., ein Vertreter der Familie Diplogasteridae gefunden, der als *Tridontus longicaudatus* Khera, 1965 bestimmt wurde. Da die Originalbeschreibung dieser Art nicht ganz korrekt ist, wird eine eingehende Neubeschreibung gegeben. Die Gattung *Syedella* Suryawanshi, 1971 wird mit *Tridontus* synonymisiert. *Syedella aurangabadensis* und *Koerneria* sp. Heyns, 1971 werden als identisch mit *T. longicaudatus* betrachtet.

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FONDATION POUR FAVORISER
LES
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RECHERCHES ENTREPRISES
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DE LA
RÉPUBLIQUE DU ZAÏRE

Exploration du Parc National des Virunga

MISSIONS G. F. DE WITTE (1933-1935) et H. DAMAS (1935-1936)

FASCICULE 1

A TAXONOMIC REVISION OF THE NEMATODE SPECIES DESCRIBED BY S. STEKHOVEN & TEUNISSEN (1938) and S. STEKHOVEN (1944) FROM NATIONAL VIRUNGA PARK (ZAÏRE REPUBLIC)

I. — DORYLAIMIDAE, APORCELAIMIDAE and LONGIDORIDAE

BY

Q. H. BAQRI and A. COOMANS (Gent)

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PARC NATIONAL DES VIRUNGA
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I. — DORYLAIMIDAE, APORCELAIMIDAE and LONGIDORIDAE

BY

Q. H. BAQRI and A. COOMANS (Gent)

INTRODUCTION

This is the first paper dealing with a revision of the taxonomic work published by SCHUURMANS STEKHOVEN & TEUNISSEN (1938) and SCHUURMANS STEKHOVEN (1944). The nematode species described in both publications were collected from the National Albert Park, Congo, respectively by G. F. DE WITTE in 1933-35 and by H. DAMAS in 1935-36.

The 1938 publication was composed of two parts, the first dealing with taxonomy and distribution, the second with biology. In the taxonomical part, 84 species were reported from 39 samples collected at 10 different localities. Out of these, 28 species were described as new (including one new genus). In the 1944 publication 12 species were identified from 27 samples, but descriptions and illustrations were given for only 7 species, two of these were new.

Some of the new species have been described on a single adult specimen, on juveniles or even on a single juvenile. Other descriptions were based on a

In this publication, the name "Congo" is to be replaced by "Zaïre", and the name "Parc National Albert (P.N.A.)" by "Parc National des Virunga (P.N.V.)".

complex of different species. Apart from this, most of the illustrations and descriptions are inadequate because some important characters have been ignored and obvious mistakes were made. Therefore it is necessary to reillustrate and redescribe the species listed in both publications.

In the present paper the representatives of the families DORYLAIMIDAE and APORCELAIMIDAE are revised, in two subsequent papers those of the families ACTINOLAIMIDAE and BELONDIRIDAE will be considered. The representatives of the family LONGIDORIDAE have been redescribed earlier by LUC & TARJAN (1963) and TARJAN & LUC (1963). Here only the occasional finding of one *Longidorus* species is reported.

It should be stressed that the above mentioned families are considered here as belonging to the superfamily DORYLAIMOIDEA. Apart from NYGOLAIMOIDEA no other superfamily is recognised under *Dorylaimina* (cf. also DE CONINCK, 1965 and COOMANS & LOOF, 1970). Furthermore the family PRODORYLAIMIDAE is not accepted. The main reason for this attitude is that the authors feel that the recent trend to raise the rank of many taxa in the *Dorylaimina* is not justified. A detailed discussion on this problem is however beyond the scope of this paper.

Unless otherwise stated the type specimens are at present deposited in the Collection of the " Institut royal des Sciences naturelles de Belgique ", Vautierstraat 31, Brussels. It is, however, not excluded that they will be transferred later on, either to the " Institut des Parcs Nationaux du Congo " or to the " Musée royal de l'Afrique Centrale ".

MATERIALS AND METHODS.

The whole material was deposited in the Royal Institute of Natural Sciences at Brussels (Institut royal des Sciences naturelles de Belgique). Through the courtesy of Prof. W. ADAM the material was made available for present study.

The nematodes were preserved in formalin and stored in glass tubes. For every sample, each species was kept in a separate tube. Most of the tubes were numbered and catalogued with full informations corresponding to the publications, but on some tubes the details about sample number and locality were missing. The number of specimens was often mentioned, but occasionally a lower of higher number was found in the tubes. Few tubes were found empty. Some nematodes were in poor condition or very dark.

The dark specimens had to remain several years in glycerine for clearing, others were processed according to the Seinhorst (1962) as modified by DE GRISSE (1969). All specimens have been mounted in dehydrated glycerine on aluminium slides. A camera lucida has been used for the diagrams and for the measurements. GERAERT's (1961) formula has been used for correcting the body width measurements in flattened specimens. Positions of œsophageal gland nuclei and outlets are given according to LOOF & COOMANS (1970).

Numerical data are presented mostly in tabelized form. The following terminology and abbreviations have been used in the tables :

L, a, b, c, V, T, G_1, G_2 : usual modified de Man formula.

cut. m. : thickness of cuticle at mid-body in microns.

cut. t. : maximum thickness of cuticle on tail.

lat. b. p. : total number of lateral body pores.

lat. b. p. oes. : lateral body pores in oesophageal region.

lat. b. p. ca-V : lateral body pores between cardia and vulva region.

lat. b. p. V-prer. : lateral body pores between vulva and intestine-pre-rectum junction.

lat. b. p. prer. + r. : lateral body pores in prerectum and rectum region.

c. p. : caudal pores.

vent. b. p. : ventral body pores.

dors. b. p. : dorsal body pores.

A : width at neck base divided by lip region width.

B : lip region width divided by lip region height. Height of the lip region measured from anterior extremity to the labial constriction or to the amphidial aperture in the case of not offset lip region.

amph. w. : width og amphidial slit in microns.

sens. : distance of sensilla pouches from the amphidial slit in microns.

od. st. : length of odontostyle in microns.

od. st. ap. : length of odontostyle aperture in microns.

g. r. : guiding ring from anterior extremity in microns.

od. ph. : length of odontophore in microns.

prer. : length of prerectum in microns.

r. : length of rectum in microns.

an. dia. : body diameter at anus in microns.

t. : length of tail in microns.

nrv. r. : distance from anterior extremity to the middle of nerve ring in microns.

egg : length and width of the egg.

spic. : length of spicules along the curved median line in microns.

l. g. p. : length of lateral guiding pieces in microns.

supp. : number of ventromedian supplements.

s. v. p. : number of subventral papillae.

cop. mus. : number of copulatory muscles.

sperm : length of sperms in microns.

DESCRIPTIONS

In the following table the species described by S. STEKHOVEN & TEUNISSEN (1938) and S. STEKHOVEN (1944) are listed on the left side under the name mentioned in those publications. A single asterisk refers to the 1944-, a double asterisk to the 1938-paper. On the right side the present status of the species is given.

Status of *Dorylaimidae* **and** *Aporcelaimidae*
described by S. STEKHOVEN & TEUNISSEN, 1938 (**) **and** S. STEKHOVEN, 1944 (*).

Past.	Present.
** *Dorylaimus filiformis* BASTIAN, 1865.	1. *Prodorylaimus paralongicaudatus* (MICOLETZKY, 1925) ANDRÁSSY, 1959.
	2. *Prodorylaimus* spec.
** *Dorylaimus stagnalis* DUJARDIN, 1845.	*Dorylaimus stekhoveni* sp. n.
** *Dorylaimus longicaudatus* BÜTSCHLI, 1874.	*Dorylaimus* spec.
** *Dorylaimus ruwenzorii* DE CONINCK, 1935.	*Mesodorylaimus ruwenzorii* (DE CONINCK, 1935), ANDRÁSSY, 1959.
** *Dorylaimus effilatus* S. STEKHOVEN & TEUNISSEN, 1938.	*Mesodorylaimus effilatus* (S. STEKHOVEN & TEUNISSEN, 1938) comb. n.
* *Dorylaimus filiformis* BASTIAN, 1865.	*Mesodorylaimus kamandeanus* sp. n.
** *Dorylaimus parafecundus* DE CONINCK, 1935.	*Mesodorylaimus* spec.
* *Dorylaimus parhomalopapillatus* S. STEKHOVEN, 1944.	*Laimydorus parhomalopapillatus* (S. STEKHOVEN, 1944) comb. n.
* *Dorylaimus flavomaculatus* VON LINSTOW, 1876.	*Laimydorus* spec.
** *Dorylaimus granuliferus* COBB, 1893.	*Eudorylaimus granuliferus* (COBB, 1893) ANDRÁSSY, 1959.
** *Dorylaimus iners* BASTIAN, 1865.	*Eudorylaimus* spec.
** *Longidorus multipapillatus* S. STEKHOVEN & TEUNISSEN, 1938.	*Longidorella multipapillata* (S. STEKHOVEN & TEUNISSEN, 1938) SIDDIGI, 1962.
** *Dorylaimus obtusicaudatus* BASTIAN, 1865.	1. *Aporcelaimellus obtusicaudatus* (BASTIAN, 1865) ALTHERR, 1968.
	2. *Aporcelaimellus kikereensis* sp. n.
	3. *Discolaimus major* THORNE, 1939.

Not included in the present study :

** *Dorylaimus metobtusicaudatus* S. STEKHOVEN & TEUNISSEN, 1938. On this species will be reported elsewhere.

** *Dorylaimus infecundus* COBB. Specimen lost.

** *Dorylaimus lentifer* S. STEKHOVEN & TEUNISSEN, 1938. Specimen lost. Gen. et species inquirendae probably belonging to *Aporcelaimidae*.

** *Dorylaimus maximodorus* S. STEKHOVEN & TEUNISSEN, 1938. Specimen lost. In view of the body length (3.14 mm) and the fact that it apparently is a first stage juvenile (cf. Fig. 71 A of S. STEKHOVEN & TEUNISSEN, 1938) this species may belong to *Ischiodorylaimus,* hence becomes *Ischiodorylaimus maximodorus* (S. STEKHOVEN & TEUNISSEN, 1938) comb. n. It should however be considered as species inquirenda till topotypes have been found.

** *Dorylaimus* spec. Specimen lost.

** *Dorylaimus stagnalis* DUJARDIN. Specimen lost.

** *Aporcelaimus eurydorus* (DITLEVSEN). Specimen lost.

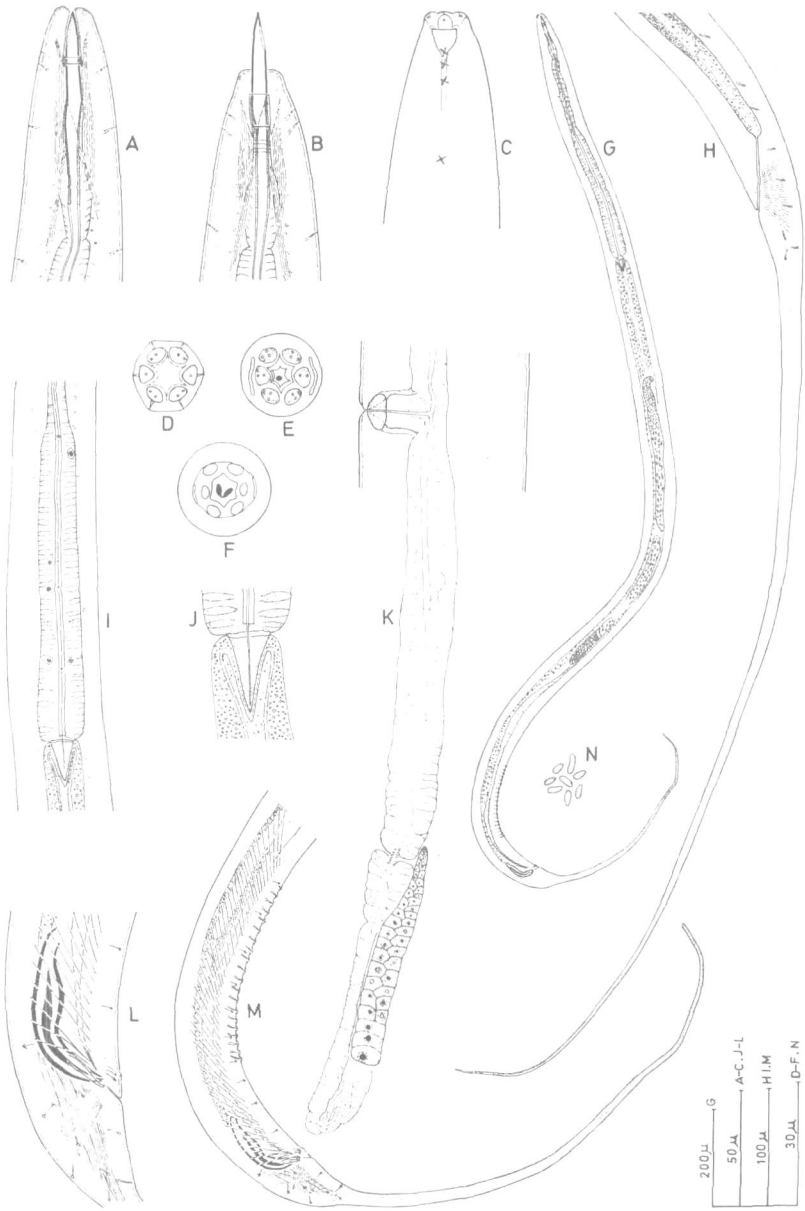

FIG. 1. — *Prodorylaimus paralongicaudatus* (MICOLETZKY, 1925).

A and B : Anterior regions; C : surface view of anterior region; D and E : *En face* view; F : Cross section just posterior to lip region; G : Entire male; H : Female rail region; I : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; J : Oesophago-intestinal junction, cardia; K : Female posterior gonad; L : Spicular region; M : Posterior body region of male; N : Spermatozoa.

Family DORYLAIMIDAE de Man, 1876.

Genus **PRODORYLAIMUS** Andrássy, 1959.

S. Stekhoven & Teunissen (1938) reported *Dorylaimus filiformis* Bastian, 1865 from various localities. For present study two females of Sesero-population, one female and one male of Tshumba-population, one partially distorted female and seven juveniles of Tshengelero-population and one totally distorted female of Mubiliba-population were available. None of these specimens represents *Paradorylaimus filiformis* (Bastian, 1865) Andrássy, 1969 but they represent two distinct species of the genus *Prodorylaimus* Andrássy, 1959.

The two females from Sesero-population are described below as *Prodorylaimus* spec., the remaining specimens have been identified as *Prodorylaimus paralongicaudatus* (Micoletzky, 1925) Andrássy, 1959.

Prodorylaimus paralongicaudatus (Micoletzky, 1925) Andrássy, 1959.

Syn. *Dorylaimus filiformis* apud S. Stekhoven & Teunissen, 1938 partim.
Nec *Dorylaimus filiformis* Bastian, 1865
= *Paradorylaimus filiformis* (Bastian, 1865) Andrássy, 1969.

Measurements. — Refer to Table 1 (Fig. 1).

Description. — Female : Body ventrally curved in the posterior half, tapering gradually towards both extremities. Cuticle finely striated transversally. Lateral chords about 1/5th of the body width near middle.

Lip region narrower than adjoining body, slightly marked by a depression. Lips bearing the usual number of papillae, in two circlets (10+6); the submedian papillae occupy an anterior position (Fig. 1 D). Amphids deep, stirrup-shaped; slit occupying about half of the corresponding body width. Sensillar pouches not seen. Odontostyle about two lip region widths long, its lumen slightly wider than corresponding body cuticle; aperture less than half the odontostyle length. Guiding ring 1.2-1.3 lip region widths from anterior end.

Foremost portion of oesophagus forming an ellipsoidal, distinctly offset swelling. The constriction separating this swelling from the remaining part of the oesophagus has been called " postextension constriction " here it will be called " postodontophore constriction ". Basal expanded portion of oesophagus occupying 47-50 % of the neck region. Positions of oesophageal gland nuclei and orifices as follows :

DO = 51-53.6
DN = 54-57
DO-DN = 2.9-3.4

K = 79-83

S_1O_1, S_1N_1 = 70-71
S_1O_2, S_1N_2 = 74-75
S_2N = 82-83
S_2O = 83-84
K′ = 81-85

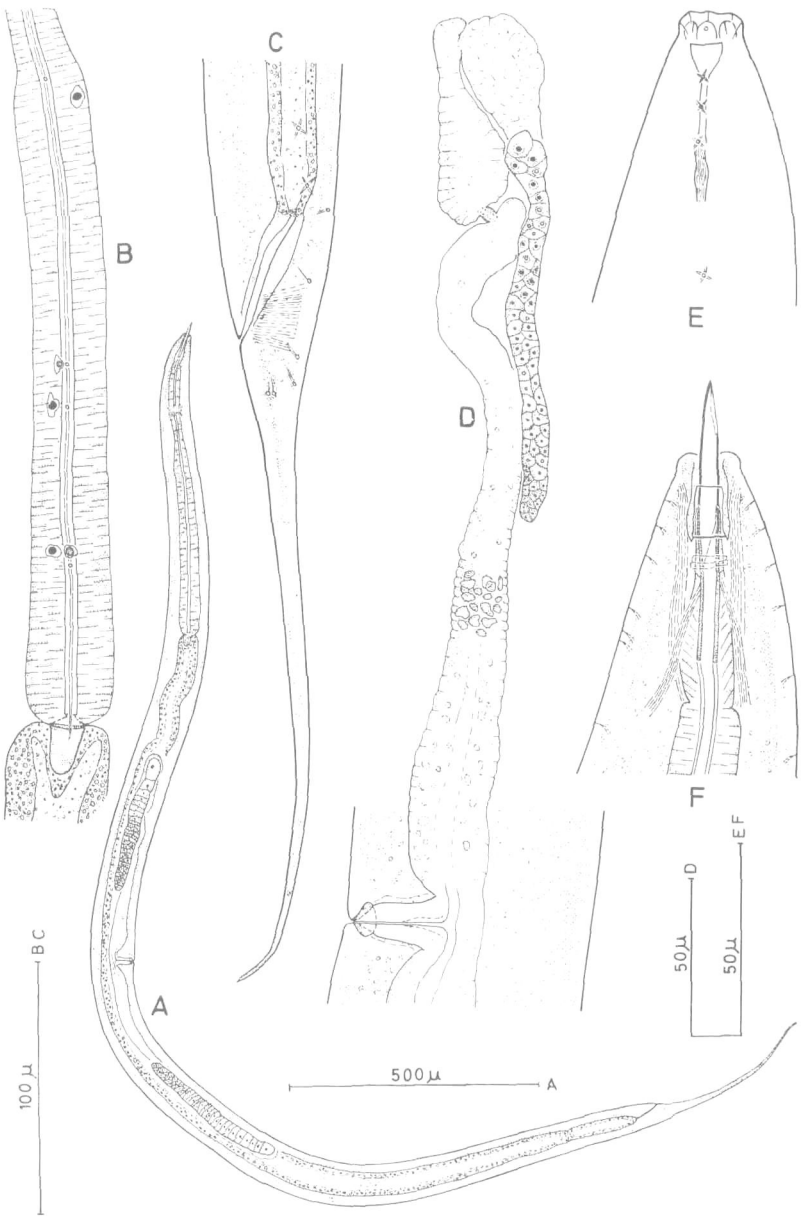

FIG. 2. — *Prodorylaimus* spec.

A : Entire female; B : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; C : Female tail region; D : Female anterior gonad; E : Surface view of anterior region; F : Anterior region.

Cardia elongate-conoid, less than half of the corresponding body width long. A narrow oesophago-intestinal disc present. Prerectum 2.5-3 anal body widths long, with a single median piece. Lateral guiding pieces more or less rod-

Vulva transverse. Vagina more than 1/3rd of corresponding body width long, with weakly sclerotized distal part appearing as two pieces in lateral view. Gonads amphidelphic. Uterus much longer than oviduct. Ovaries with oocytes mostly arranged in double row.

Tail very long, filiform with acute terminus; about 23-24 anal body widths long; with 3 caudal pores on each side. Male : Similar to female in general shape and morphology except for the more curved posterior half. Male gonads typical. Spermatozoa oval in shape. Spicules about 1.9 anal body widths long, with a single median piece. Lateral guiding pieces more or less rod-shaped. In addition to the adanal pair, 20 ventromedian supplements present, spaced closely at regular intervals. Eleven irregularly spaced subventral papillae reach from near the anus up to the foremost supplement.

Prerectum about 4 anal body widths long, starting from halfway the supplement region. Tail similar to female though possibly shorter (exact length not known because of broken tip !); with 8 caudal pores on each side.

Localities and habitats. — Sample no. 377 : collected from Tshumba, Mushari region, South-West of Rutshuru; Alt. 2,100 m near the village and Alt. 1,700 m in the lava plain. Volcanic shingle almost without organic components.

Sample no. 533 : collected from Tshengelero, swamp, North of Munagana; Alt. 1,750 m.

Sample no. 1518 : collected from Mubiliba, small wood in the lava plain of the Nyamuragira volcano; Alt. 2,000 m.

Remark. — There is no record of specimens from Tshumba by S. STEKHOVEN & TEUNISSEN (1938, p. 114 or p. 137). The male and female described and reported here have been found in a tube labelled as *Dorylaimus filiformis,* Tshumba, sample no. 377.

Prodorylaimus spec.

Syn. *Dorylaimus filiformis* apud S. STEKHOVEN & TEUNISSEN, 1938, partim.

(Fig. 2.)

Measurements. — Refer to Table 1.

Description. — Female : Body irregularly curved, gradually tapering towards both extremities. Cuticle finely striated transversally. Lateral chords about 1/5-1/4th of the body width near middele. Lateral body pores faint.

Lip region narrower than adjoining body and marked by a depression. Lips bearing the usual number of papillae in two circlets (10+6). Amphids deep, stirrup-shaped; slit about half of the corresponding body width. Position of

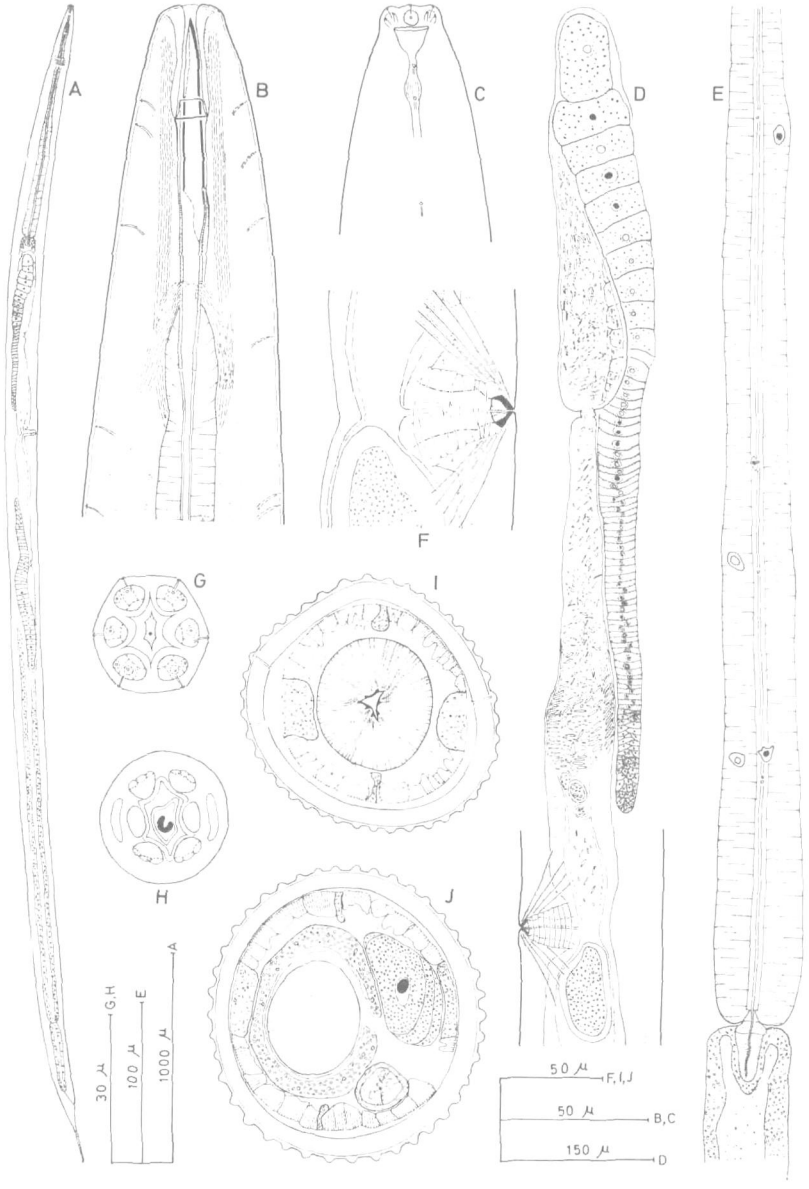

FIG. 3. — *Dorylaimus stekhoveni* n. sp.

A : Entire female; B : Anterior region; C : Surface view of anterior region; D : Female anterior gonad; E : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; F : Vulval region; G : *En face* view; H : Cross section just below lip region; I : Cross section through basal expanded portion of oesophagus; J : Cross section through mid-body.

sensillar pouches not certain, because of the presence of two swellings (Fig. 2 E). Odontostyle 1.8-1.9 lip region widths long, its lumen wider than the corresponding body cuticle; aperture slightly less than half of the odontostyle length.

Postodontophore constriction present. Basal expanded portion of oesophagus occupying about 49-52 % of neck region. Positions of oesophageal gland nuclei and orifices as follows :

DO = 48.6-50.6
DN = 50.3-52.5
DO-DN = 1.7-1.9

S_1O_1, S_1N_1 = 69-71
S_1O_2, S_1N_2 = 73-75
S_2N = 84-85
S_2O = 85-86

K = 85-86
K′ = 87

Cardia conoid with broadly rounded tip. A very narrow oesophago-intestinal disc present. Prerectum about 4.5 anal body widths and rectum about 1.5 anal body widths long.

Vulva transverse. Vagina slightly less than half of the corresponding body width, with weakly sclerotized distal part appearing as two pieces in lateral view. Uterus very long, with " Z-organ " composed of weakly sclerotized apophyses. Oviduct very short. In one female the ovaries are narrow with small oocytes arranged in a double and even triple row (Fig. 2 D); in the other specimen the ovaries are wider with oocytes arranged in a double and single row. Spindle-shaped sperms are present in the uteri of one female.

Tail long, filiform with acute terminus; 9-10 anal body widths long; 4 caudal pores on each side.

Male : not found.

Locality and habitat. — Sesero Mountain, North of the Mikeno volcano, bambou and mixed wood, region of Gashole-Sesero Mountains; Alt. 2,000 m.

Remark. — *Prodorylaimus* spec. comes very close to *P. dahli* (Altherr, 1960) Andrássy, 1964 in many respects, excepts in having a stouter body (a = 50-54 in *P. dahli*). Since we have only two females and males were not present in the collection, the species — which may be new — is not named.

Genus **DORYLAIMUS** Dujardin, 1845.

Dorylaimus stekhoveni sp. n.

Syn. *Dorylaimus stagnalis* apud S. Stekhoven, 1944.
Nec *Dorylaimus stagnalis* Dujardin, 1845.

(Figs. 3 and 4.)

Dorylaimus stekhoveni n. sp. was collected in large number from different localities and was identified by S. Stekhoven (1944) as *D. stagnalis* Dujardin, 1845.

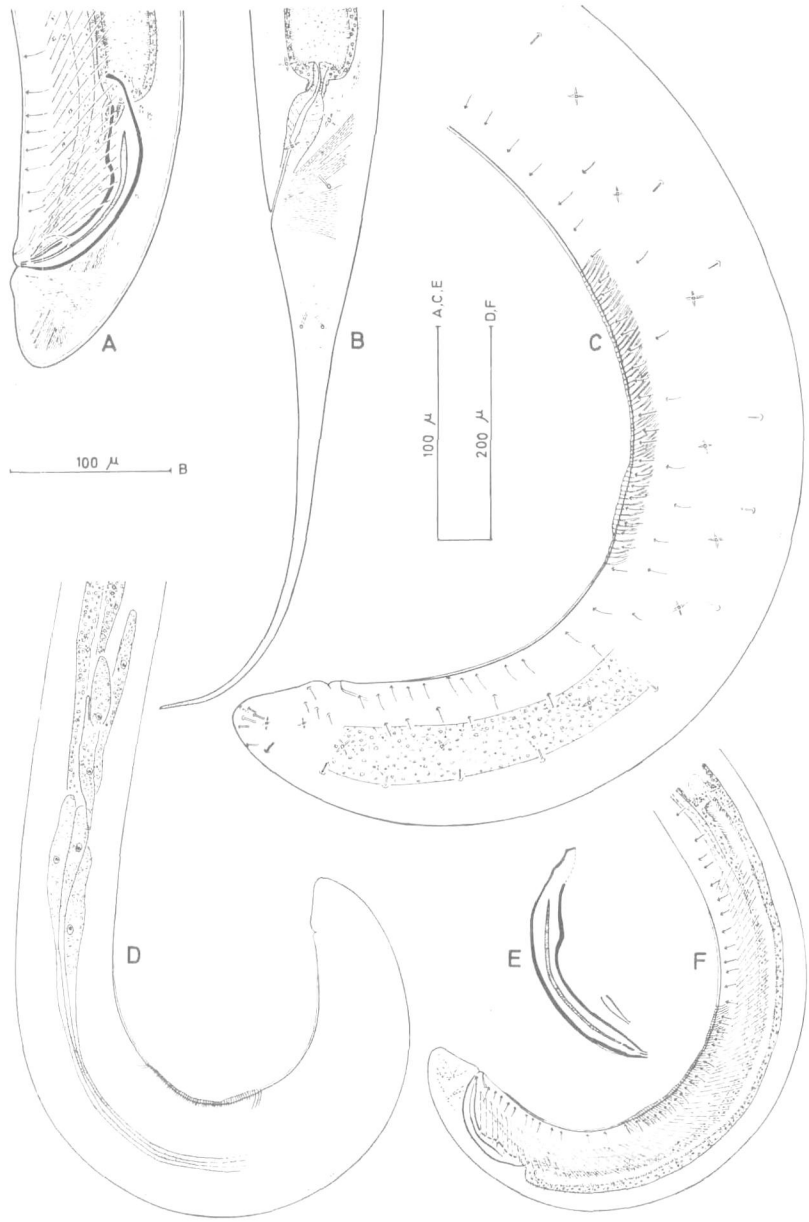

FIG. 4. — *Dorylaimus stekhoveni* n. sp.

A : Male tail region; B : Female tail region; C : Surface view of posterior body region of male, showing supplements, subventral papillae, lateral body pores; D : Posterior end of male body, showing ejaculatory glands; E : Spicules and lateral guiding pieces; F : Posterior body region of male.

For the present study, many specimens were available from Gando (samples nos. 42, 46 and 49), one female from Kisenyi (sample no 261) and one juvenile from Ondo (sample no. 287).

D. stagnalis was also reported by S. STEKHOVEN & TEUNISSEN (1938) but these specimens (1 ♂, 2 juv.) could not be traced in the collection.

Measurements. — Refer to Table 2.

Description. — Female : Body straight or ventrally curved posterior to vulva, slightly tapering towards both extremities. Cuticle finely striated transversally, marked with 41 longitudinal lines in the middele and at base of oesophagus (Fig. 3 I, J). Lateral chords about 1/4th-1/3rd of the corresponding body width near middle.

Lip region slightly narrower than adjoining body, slightly marked by a depression. Lips amalgamated, bearing the usual number of papillae in two circlets (10+6); subdivided in four sects (Fig. 3 G). Oral aperture hexagonal but dorsoventrally elongated. Amphids stirrup-shaped, slit about half of the corresponding body width. Odontostyle 2.3-2.6 lip region widths long; its lumen about as wide as the corresponding body cuticle; aperture less than half the odontostyle length. Guiding ring 1.6-1.9 lip region widths from anterior extremity.

Basal expanded portion of oesophagus 52-55 % of neck region. Positions of oesophageal gland nuclei and orifices as follows :

DO = 46.9-49.0	S_1O_1, S_1N_1 = 66-68
DN = 48.0-50.9	S_1O_2, S_1N_2 = 73-76
DO-DN = 1.1-1.9	S_2N = 83-85
	S_2O = 84-86
K = 71-77	K′ = 73-78

Cardia cylindrical to tongue-shaped, surrounded by intestinal tissue. Prerectum 5-8 anal body widths long; cells usually with well developed microvilli. Rectum 1.3-1.7 anal body widths long, separated by a well developed sphincter from the prerectum.

Vulva transverse. Vagina 42-56 μ long, extending less than halfway the corresponding body width, with sclerotized distal part appearing as two refractive pieces in lateral view. Gonads amphidelphic. Usually a female contains 2-3 eggs, but in one female there are 11 eggs in the anterior uterus and 12 in the posterior.

Tail elongate, tapering gradually, 5-7 anal body widths long; with 2-3 caudal pores on each side.

Male : Similar to female in general shape and morphology except for the more ventrally curved posterior part of the body and the differently shaped tail. Male gonads typical. Spermatozoa elliptical. Three pairs of ejaculatory glands are visible in the prerectum region; the posterior part of the ducts could not be discerned; because of distortion the six glands may be visible from one side of the body (Fig. 4 D).

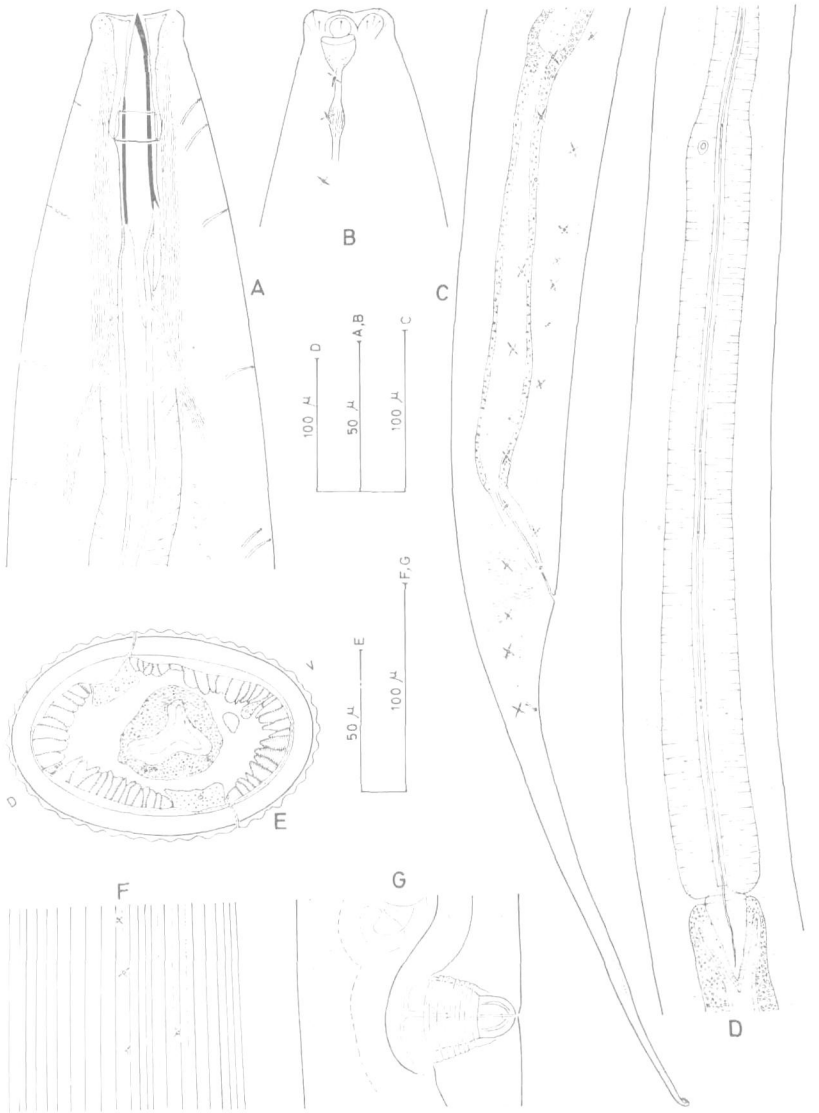

FIG. 5. — *Dorylaimus* spec.

A : Anterior region; B : Surface view of anterior region; C : Posterior body region of female; D : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; E : Cross section through mid-body; F : Surface view in mid-body, longitudinal lines and lateral body pores; G : Vulval region.

Spicules 2-2.4 anal body widths long, with a simple median piece. Lateral guiding pieces more or less rod-shaped. In addition to the adanal pair, 55-62 contiguous and regularly spaced ventromedian supplements are present. Subventral papillae spaced irregularly, reaching anterior to junction between intestine and prerectum; one postanal subventral papilla also present. Numerous lateral body pores occur in the caudal region (Fig. 4 C).

Prerectum starting anterior to the copulatory muscles; 9-13 anal body widths long. Tail convex-conoid with rounded terminus, about 3/4th of anal body width long; with 10-12 caudal pores on each side.

Differential diagnosis. — *Dorylaimus stekhoveni* n. sp. comes close to *D. tepidus* ANDRÁSSY, 1959 but differs from it in having more longitudinal lines (32 in *D. tepidus*), comparatively longer odontostyle (2.1-2.2 lip region widths long in *D. tepidus*); longer spicules (100-106 μ in *D. tepidus*) and more supplements (35-39 in *D. tepidus*). It also resembles *D. montanus* STEFANSKI, 1923 but differs from this species by body length (L = 3.2-4.8 mm in *D. montanus*) and number of supplements (25-35 in *D. montanus*).

Type specimens. — Holotype female along with one paratype female on slide *Dorylaimus stekhoveni* SS/1. Paratype males and females on slides *D. stekhoveni* SS/2-31.

Type locality and habitat. — Specimens collected by H. DAMAS from the upper lake at Gando.

Other localities. — One female from Kisenyi, Edward Lake; one juvenile female from the bank of Ondo river.

Dorylaimus spec.

Syn. *Dorylaimus longicaudatus* apud S. STEKHOVEN & TEUNISSEN, 1938 partim.
Nec *Dorylaimus longicaudatus* BÜTSCHLI, 1874.
= *Prodorylaimus longicaudatus* (BÜTSCHLI, 1874), ANDRÁSSY, 1959.

(Fig. 5.)

S. STEKHOVEN & TEUNISSEN (1938) reported *Dorylaimus longicaudatus* from Eala, Tshumba (sample no. 377), Kibga (sample no. 1075), Kasenze (sample no. 1204), Rutshuru, Rwepa river (sample E) and Rwindi (sample G). Figure 64 B in their publication represents a male tail of a specimen that probably belongs to the genus *Prodorylaimus*.

Unfortunately only one specimen (a female from Kibga) was present in the collection. This female belongs to the genus *Dorylaimus*. As in some other instances, S. STEKHOVEN & TEUNISSEN (1938) identified here a complex of different species belonging to different genera as one species.

Measurements. — Refer to Table 2.

Description. — Female : Body slightly curved ventrally, slightly tapering towards both extremities. Cuticle finely striated transversally, marked with 44 longitudinal lines in the middle of the body. Here and there some faint lines visible (Fig. 5 F); in transverse section they appear as minor projections between two major ones (Fig. 5 E). Lateral chords 1/5th of body width near middle.

Lip region wider than adjoining body offset by a moderate constriction. Lips subangular in superficial view; bearing the usual number of papillae. Amphids cup-shaped, slit less than half of the corresponding body width. Odontostyle 2.1 lip region widths long; its lumen about equally wide as the corresponding body cuticle; aperture slightly more than 1/3rd of odontostyle length. Closed part of odontophore well developed, appearing in lateral view as a 27 μ long sclerotized rod at the ventral base of the odontostyle (Fig. 5 A). Guiding ring 1.3 lip region widths from anterior extremity.

Basal expanded portion of oesophagus occupying about 56 % of neck region. Except for the dorsal oesophageal gland nucleus, no gland nuclei could be observed, but gland orifices are well visible :

DO = 47.0	$S_1O_1 = 61$	$S_2O_1 \simeq 78$
DN = 48.3	$S_1O_2 = 66$	$S_2O_2 \simeq 78.5$
DO-DN = 1.3	K' = 73.7	

Cardia about half of the corresponding body width long, conoid, enveloped by intestinal tissue, its anterior fourth is darker than the rest. Prerectum about 5 anal body widths long. Rectum less than 1 1/2 anal body widths long.

Vulva transverse. Vagina about half the corresponding body width, with weakly sclerotized distal part. Gonads amphidelphic, details not clear.

Tail elongate, gradually tapering, tip ventrally bent and forming a hook; about 6 anal body widths long; with 4 caudal pores on each side.

Male : unknown.

Differential diagnosis. — *Dorylaimus* spec. comes close to *D. montanus* STEFANSKI, 1923 in having 44 longitudinal lines, but differs in the odontostyle being about equally wide as the corresponding body cuticle (wider in *D. montanus*), larger odontostyle aperture (less than 1/3rd in *D. montanus*), differently shaped amphids and comparatively longer oesophagus (b = 4.3-5.6 in *D. montanus*). *Dorylaimus* spec. may represent a new species but as the material is insufficient we prefer not to name it.

Locality and habitat. — Kibga, southern slope of Visoke volcano, at the fringe of a bambou forest; Alt. 2,400 m.

THE GENERA *MESODORYLAIMUS* AND *LAIMYDORUS*

The genus *Laimydorus* was differentiated from *Mesodorylaimus* mainly on the basis of the following characters : guiding ring double (*L.*) against single (*M.*), vulva longitudinal (*L.*) against transverse (*M.*), supplements contiguous (*L.*) against mot (*M.*), prerectum in the male extending well beyond the supplement region (*L.*) against not extending beyond this region (*M.*).

On this basis many species can be attributed to either of these genera. Some species, however, present a mixture of characters considered typical for both genera. The diagnostic value of " single " or " double " guiding ring has been discussed by GOODEY (1961) and COOMANS (1964). Both genera have the fixed guiding at such a position that only a slight shift of the spear will make the guiding ring appear as " double " in those species were the " single " condition exists when the spear is fully retracted. Hence this character is not very reliable to differentiate both genera. The shape of the vulva slit has not been described for a number of species; combined with other characters, it may be perhaps a good character. The distribution of the supplements may, in other dorylaimid genera vary a lot and the reliability of this character for distinguishing *Laimydorus* from *Mesodorylaimus* has to be further documented. It should be stressed that some species currently considered under *Mesodorylaimus* possess contiguous supplements ! The length of the male prerectum is often not reliable since several exceptions exist. Because of this some species from the present collection, belonging to one or the other of both genera were difficult to place. The names proposed are thought to be the best compronise at present. Specific problems will be discussed under the heading " Remarks " after each description.

Genus **MESODORYLAIMUS** ANDRÁSSY, 1959.

Mesodorylaimus ruwenzorii (DE CONINCK, 1935) ANDRÁSSY, 1959.

Syn. *Dorylaimus ruwenzorii* DE CONINCK, 1935.

(Fig. 6.)

Measurements. — Refer to Table 3.

Description. — Male : Body ventrally curved, slightly tapering towards anterior end. Cuticle finely striated transversally. Lateral chords narrow, about 1/10th of body width near middle. Only some body pores visible.

Lip region slightly marked by a depression. Lips rounded. Amphids deep, stirrup-shaped; apertures less than half of the corresponding body width.

Odontostyle 1.3 lip region widths long; its aperture about 1/3rd of the length. Guiding ring less than one lip region width from anterior extremity; appearing " double " because of protruded stylet.

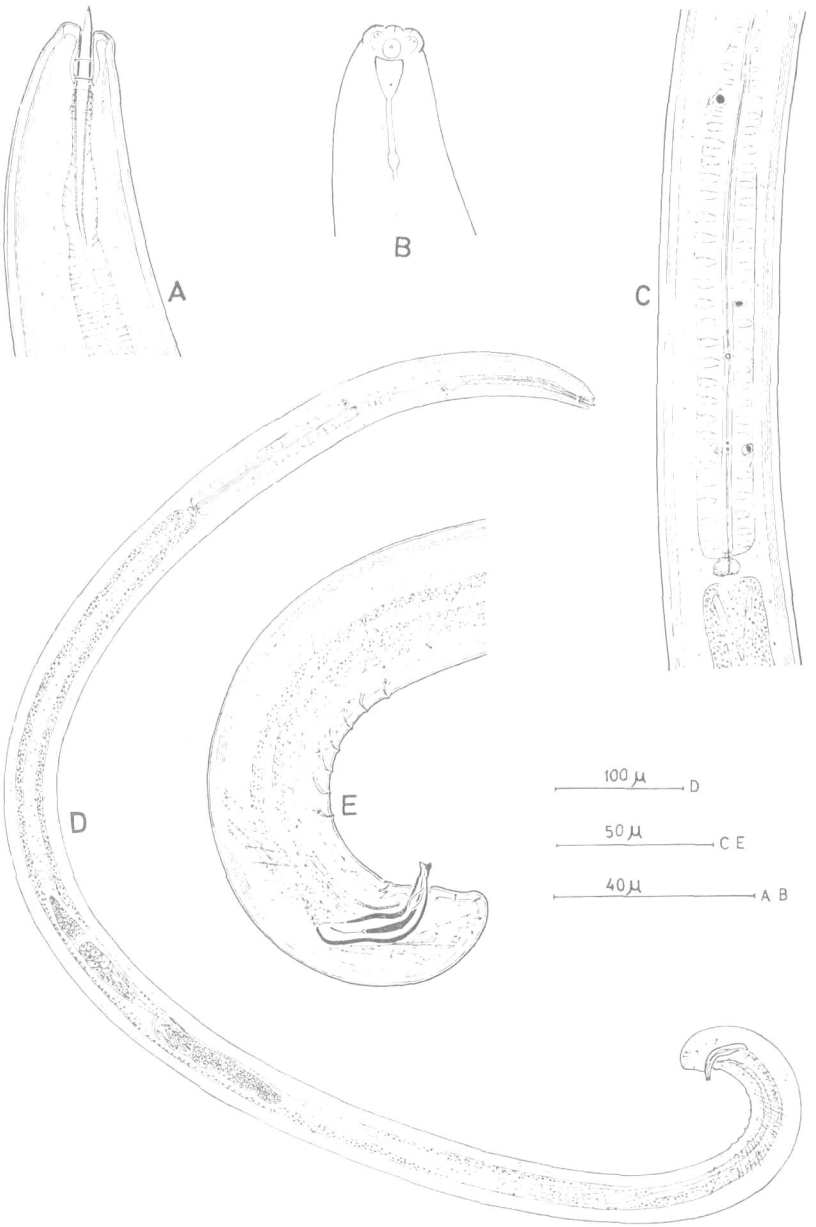

FIG. 6. — *Mesodorylaimus ruwenzorii* (DE CONINCK, 1935).

A : Anterior region; B : Surface view of anterior region; C : Basal expanded *portion of oesophagus, oesophageal gland nuclei and orifices;* D : Entire male; E : Posterior body region of male.

Basal expanded portion of oesophagus occupying about 46 % of the neck region. Locations of oesophageal gland nuclei and orifices as follows :

DO = 56.0	S_1O_1, S_1N_1 = 76
DN = 58.1	S_1O_2, S_1N_2 = 81
DO-DN = 2.1	S_2O, S_2N = 90
K = 80	K′ = 81

Exact shape of cardia not known since the intestine is detached from the oesophagus and the cardia partly damaged. Disc-like portion present. Prerectum about 5 anal body widths long; starting from opposite the first supplement.

Gonads typical. Spicules 1.8 anal body widths long, with bifurcated distal end. Lateral guiding pieces short but wide. Supplements consist of an adanal pair and 7 regularly spaced ventromedians. Subventral papillae spaced almost regularly in the region of the copulatory muscles.

Tail dorsally convex conoid with rounded terminus, about 3/4th of the anal body widths long; with 5 caudal pores on each side.

Locality and habitat. — Visoke volcano, area with *Senecio, Lobelia* a.o. around and inside the old crater; Alt. 3,770 m.

Mesodorylaimus effilatus (S. Stekhoven & Teunissen, 1938) Andrássy, 1959.

Syn. *Dorylaimus effilatus* S. Stekhoven & Teunissen, 1938.

Laimydorus effilatus (S. Stekhoven & Teunissen, 1938) Andrássy, 1969.

(Fig. 7.)

Measurements. — Refer to Table 3.

Description. — Female : Body ventrally curved, tapering slightly towards both ends. Cuticle finely striated transversally. Lateral chords about 1/3rd of the body width near middle.

Lip region wider than adjoining body, offset by a constriction. Lips sub-angular, with the usual number of papillae. Amphids stirrup-shaped, apertures occupying almost half of the corresponding body width. Sensillar pouches not seen.

Odontostyle about 1.3 lip regions widths long; aperture somewhat more than 1/3rd of the odontostyle length. Guiding ring about 0.6 times the lip region width from anterior extremity; appearing " double " because of the protruded position of the stylet.

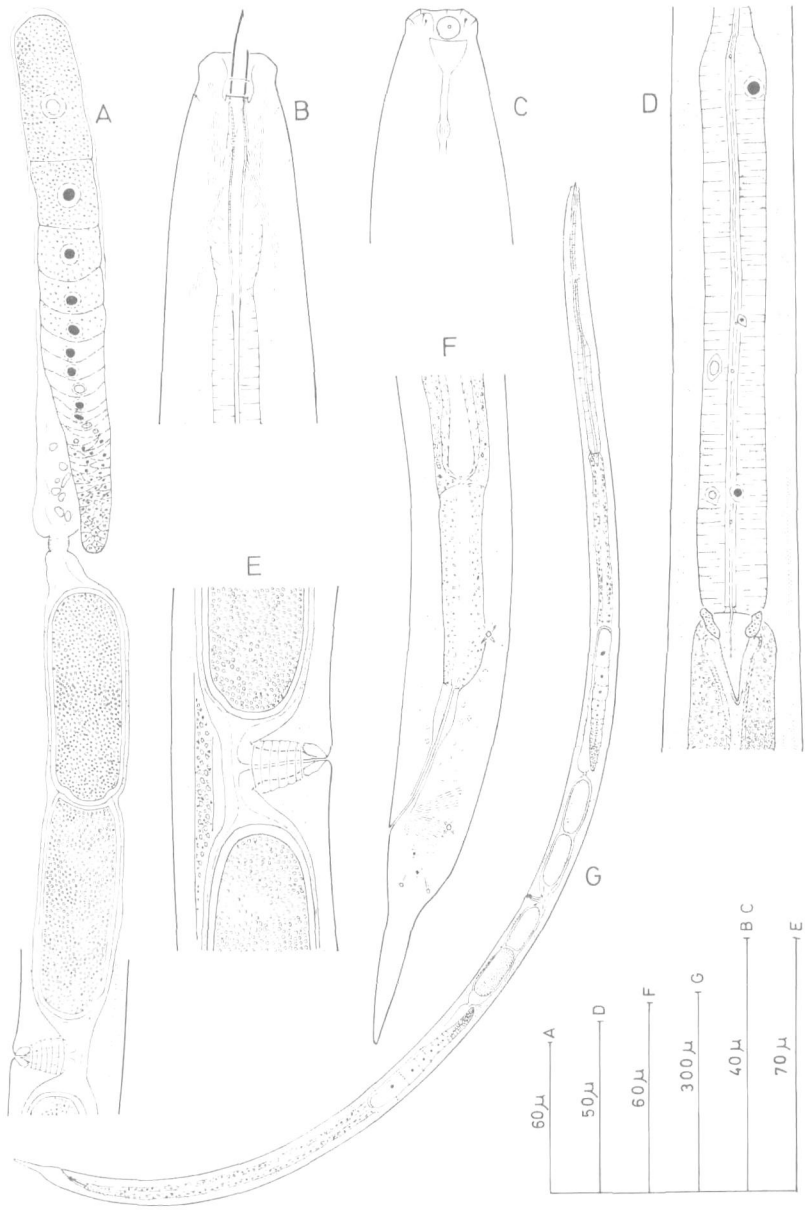

FIG. 7.

Mesodorylaimus effilatus (S. STEKHOVEN & TEUNISSEN, 1938) ANDRÁSSY, 1959.

A : Anterior female gonad; B : Anterior region; C : Surface view of anterior region; D : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; E : Vulval region; F : Posterior body region of female; G : Entire female.

Basal expanded portion of oesophagus occupying about 42 % of the neck region. Locations of oesophageal gland nuclei and outlets as follows :

DO = 60.3	S_1O_1, S_1N_1 = 78
DN = 62.6	S_1O_2, S_1N_2 = 82
DO-DN = 2.3	S_2N = 92
	S_2O = 94
K = 82	K′ = 85

Cardia conoid, more than half of the corresponding body width long; anterior third darker than remaining part. Two granular bodies surround the oesophago-intestinal junction (Fig. 7 D). Intestinal microvilli well developed. Prerectum more than 2.5 anal body widths long. Rectum about 2 anal body widths long.

Vulva a transverse slit. Vagina extending more than halfway into the body; with sclerotized distal part and well developed sphincter. Two eggs present in each uterus; few oval sperms present in both oviducts.

Tail dorsally convex-conoid in its anterior third, then suddenly narrowing to a subacute tip; 2.9 anal body widths long. Two caudal pores on each side. Two cells of unknown nature present in the tail, each with a nucleus having a small nucleolus (Fig. 7 F).

Male : *unknown.*

Differential diagnosis. — *Mesodorylaimus effilatus* comes close to *M. pseudobastiani* Loof, 1969 but differs by its relatively more slender body (a = 37-41 in *M. pseudobastiani*), higher values for K and K′ (K = 61-78, K′ = 67-78 in *M. pseudobastiani*) and by the shape of vaginal sclerotization.

Type specimens. — Although S. Stekhoven & Teunissen reported also a juvenile (from a different locality !), their description and illustration is entirely based on the female specimen. We therefore do not consider the juvenile as belonging to the original type series, so that the female specimen is to be treated as the holotype. It is mounted on slide *Mesodorylaimus effilatus* SST/31.

Type locality and habitat. — Kanyamenoni, lake, old crater in the bambou forest, near Tshamugussa, in the direction of Musule volcano, Bweza region; Alt. 2,300 m.

Remarks. — Andrássy (1959) transferred *Dorylaimus effilatus* to *Mesodorylaimus*. In 1969 Andrássy shifted the species to *Laimydorus* but mentioned Goodey in Goodey, 1963 as authority for the transfer to *Mesodorylaimus*. This is a lapsus since Goodey (1963) did not list the species and Andrássy himself proposed the transfer in 1959.

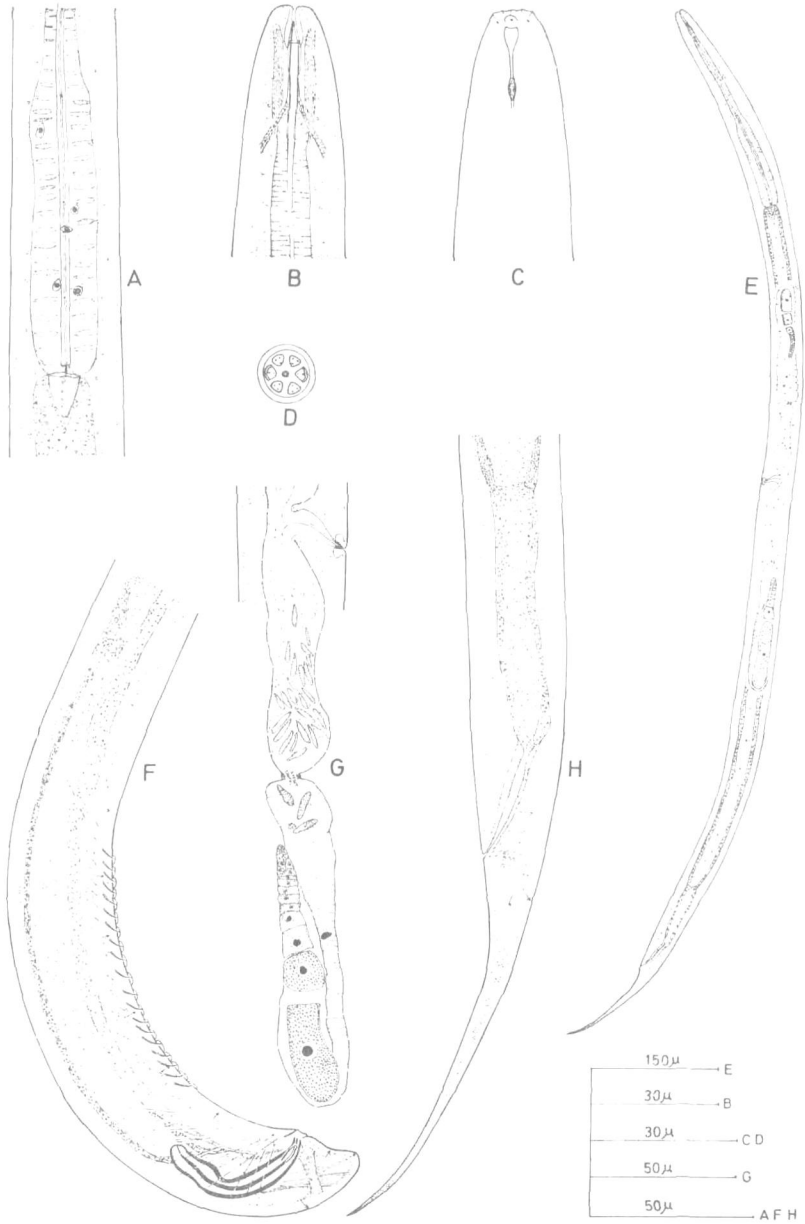

FIG. 8. — *Mesodorylaimus kamandeanus* n. sp.

A : Basal expanded portion of oesophagus; B : Anterior region; C : Surface view of anterior region; D : *En face* view; E. Entire female; F : Posterior body region of male; G : Female posterior gonad; H : Posterior body region of female.

The position of the species is doubtful, but since the fixed guide ring is less than a lip region width from the anterior extremity and because of the transverse slitlike vulva it is left under *Mesodorylaimus*.

Mesodorylaimus kamandeanus sp. n.

Syn. *Dorylaimus filiformis* apud S. STEKHOVEN, 1944.

Nec *Dorylaimus filiformis* BASTIAN, 1865

=*Paradorylaimus filiformis* (BASTIAN, 1865) ANDRÁSSY, 1969.

(Fig. 8.)

S. STEKHOVEN (1944) identified these nematodes as *D. filiformis*. He was having 22 females and 26 males from Kamande (sample no. 140), but for present study only 6 females and 7 males were available. These specimens are difficult to place since they share characters of *Mesodorylaimus* and *Laimydorus*.

Measurements. — Refer to Table 3.

Description. — Female: Body ventrally curved in the posterior half or irregularly curved, slightly tapering towards both extremities. Cuticle finely striated transversally. Lateral chords 1/6th-1/4th of the body width near mid-body. Body pores not visible.

Lip region contiguous with adjoining body. Lips with the usual number of papillae in two circlets (6+10). Amphids goblet-shaped, apertures occupying about 1/4th of the corresponding body width.

Odontostyle 1.2-1.4 lip region widths long; aperture less than half of the odontostyle length. Guiding ring about or slightly less than one lip region width behind anterior extremity; normally " single " but appearing " double " when the stylet is protruded (Fig. 8 B).

Basal expanded portion of oesophagus occupying 35-40 % of the neck region. Locations of oesophageal gland nuclei and orifices as follows:

DO = 63.1-66.2
DN = 66.4-70.0
DO-DN = 3.3-3.8

K = 79-83

S_1O_1, S_1N_1 = 78-81
S_1O_2, S_1N_2 = 81-84
S_2N = 88-90
S_2O = 89-91
K′ = 84-88

Cardia conoid with rounded tip, more than 1/3rd of the corresponding body width long, enveloped by intestinal tissue. A very narrow oesophago-intestinal disc is present. Prerectum 3-4.5 anal body widths long. In some specimens the cells of the proximal part of the prerectum bear well developed microvilli. Rectum about 1.7-1.9 anal body widths long.

Vulva a transverse slit. Vagina about 1/3rd-1/2 of the corresponding body width. Uteri somewhat shorter than oviducts. Elliptical sperms present in distal half of uterus and proximal part of oviduct.

Tail elongate-conoid, tapering gradually towards a sharp terminus, about 6-8 abal body widths long; with 2 caudal pores on each side.

Male : Similar to female in general shape and morphology, except dissimilar tail. Gonads typical. Spicules about 1.4-1.8 anal body widths long, with single median piece. Lateral guiding pieces well developed. Supplements consist of an adanal pair and 18-21 contiguously arranged ventromedians. Subventral papillae more or less regularly spaced.

Prerectum 6-8 anal body widths, starting anterior to the region of the copilatory muscles.

Tail dorsally convex-conoid with rounded terminus, about 0.8-1.4 anal body widths long; with 3 caudal pores on each side.

Differential diagnosis. — *Mesodorylaimus kamandeanus* n. sp. can be differentiated from most other *Mesodorylaimus* species by the high number of contiguous supplements and the long prerectum in the male and by its small size. It comes close to *M. thermae* (Cobb in Hoeppli, 1926) Goodey in Goodey, 1963 but differs in the number of caudal pores on the male tail (at least 6 pairs in *M. thermae*) and the differently shaped female tail.

Type specimens. — Holotype female along with one paratype female mounted on slide *Mesodorylaimus kamandeanus* SS/57. Paratype females and males mounted on slides *Mesodorylaimus kamandeanus* SS/58-63.

Type locality and habitat. — Kamande, Edward Lake; collected by H. Damas in 1935.

Remarks. — This species shares the following characters with *Mesodorylaimus* : " single " guiding ring, transverse vulva, small body size, faint body pores; with *Laimydorus* it shares the contiguously arranged supplements and the long prerectum in males. However as explained before some of these characters have doubtful diagnostic value. This also appears from a comparison with some recently described species by Loof (1969) : *Mesodorylaimus cryptosperma* Loof, 1969 possesses a longitudinal vulva, 21-25 contiguous supplements and a long prerectum in males, hence it fits the diagnosis of *Laimydorus* and is here transferred to that genus, becoming *Laimydorus cryptosperma* (Loof, 1969) comb. n. *Mesodorylaimus litoralis* Loof, 1969 possesses also a longitudinal vulva and 15-18 contiguous supplements, but has a short prerectum in the male and a " single " guiding ring. *Mesodorylaimus derni* Loof, 1969 has a longitudinal vulva and 11-20 contiguous supplements, but again a short prerectum in the male and a " single " guiding ring. Some older species currently considered under *Mesodorylaimus* as e.g. *M. alpestris* (Thorne, 1939) Andrássy, 1959, *M. clavicaudatus* (Thorne & Swanger, 1936) Andrássy, 1959, *M. tenellus* (Thorne & Swanger, 1936) Andrássy, 1959 and *M. thermae* (Cobb in Hoeppli, 1926) Goodey in Goodey, 1936 do possess contiguously arranged supplements.

From the above it is clear that a number of species do not fit well in either of both generic diagnoses and that, if both genera are real, they need a better definition. It is evident that this problem can only be solved by a careful study of as many species as possible. Therefore we propose to use the oldest name (*Mesodorylaimus*) for all the doubtful cases until this better definition is provided.

Mesodorylaimus spec.

Syn. *Dorylaimus parafecundus* apud S. STEKHOVEN & TEUNISSEN, partim.
Nec *Dorylaimus parafecundus* DE CONINCK, 1935
= *Paradorylaimus parafecundus* (DE CONINCK, 1935) ANDRÁSSY, 1969.
(Fig. 9.)

S. STEKHOVEN & TEUNISSEN (1938) reported *Dorylaimus parafecundus* from Tshengelero (1 ♂), Gahinga volcano (11 ♂♂, 1 juv.), Kanyabayongo (1 ♂, 1 ♀) and Rutshuru (1 ♂). Of these specimens only the male from Tshengelero (sample no. 533) is left.

In their illustration S. STEKHOVEN & TEUNISSEN (e.c. Fig. 67) show a great variation in the number and arrangement of the ventromedian supplements, so that they were probably with a complex of different species. Although their figure 67 C shows a ventromedian series of 28 supplements it may have been drawn from the Tshengelero-specimen or at least from a specimen conspecic with it. Finally it should be pointed out that their figure 67 D, although referred to as a female tail, shows an adanal supplement and the terminal parts of spicule-protractors, hence represents a male tail.

The male from Tshengelero is in rather bad condition, especially in the region between odontophore and intestine-prerectum junction. It is nevertheless clearly different from *P. parafecundus* as described by DE CONINCK (1935).

Measurements. — Refer to Table 3.

Description. — Male : Body curved dorsally posterior to the cardia and ventrally at posterior extremity; tapering slightly towards anterior extremity. Cuticle finely striated transversally. Body pores not visible. Lateral chords about 1/8th of the body width near middle. Lip region offset by a constriction. Amphids stirrup-shaped.

Odontostyle 1.7 lip region widths long; aperture less than 1/3rd of the odontostyle length. Guiding ring idented, about one lip region width from anterior extremity.

Details of oesophagus, nerve ring and cardia not clear. Prerectum slightly more than 4 anal body widths long, starting from opposite the first ventramedian supplement.

Spicules about 2 anal body widths long. Lateral guiding pieces well developed. Supplements consisting of an adanal pair and a series of 27 contiguous ventramedians. Subventral papillae irregularly spaced, reaching beyond the prerectum.

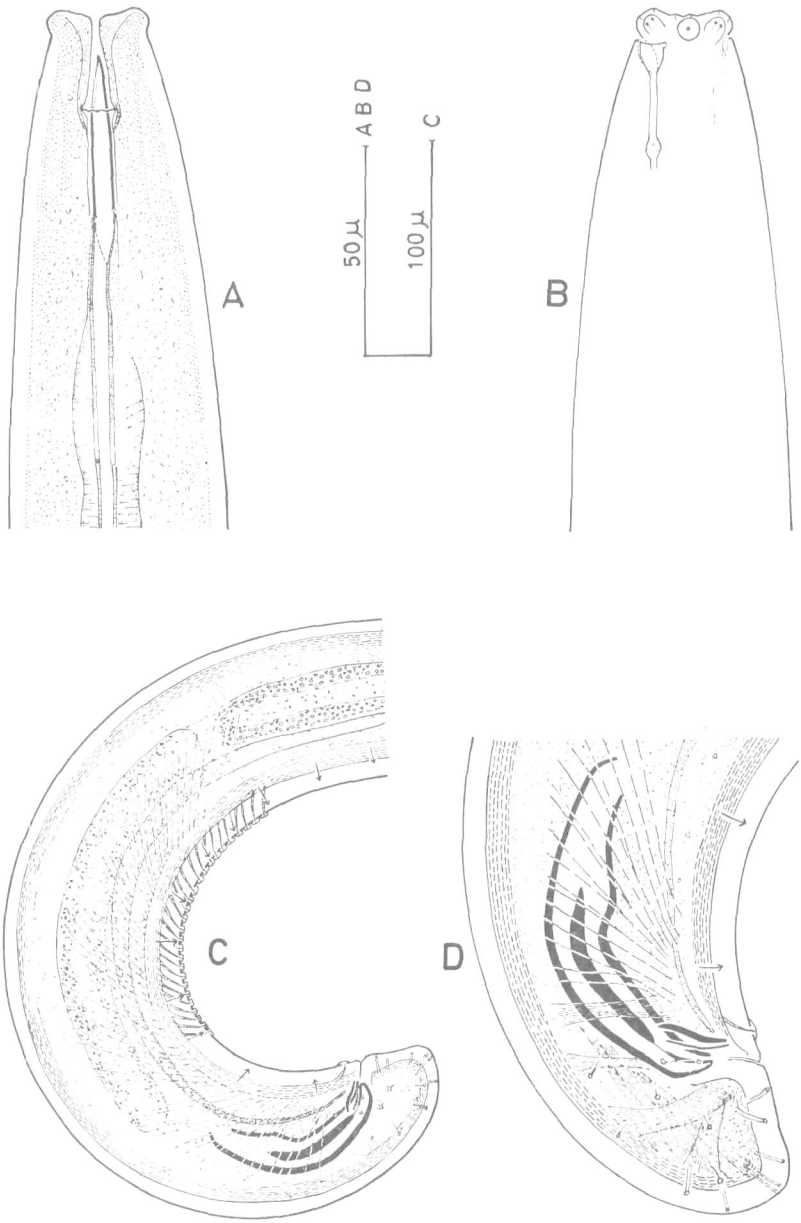

FIG. 9. — *Mesodorylaimus* spec.

A : Anterior region; B : Surface view of anterior region; C : Posterior body region of male; D : Male tail region.

Tail dorsally convex-conoid with rounded terminus, about 2/3rd of anal body width long; with 11 caudal pores on each side.

Locality and habitat. — Collected from Tshengelero, a swamp north of Munagana; Alt. 1,750 m.

Remarks. — This species shows characters of *Laimydorus* (many, contiguous supplements) and *Mesodorylaimus* (short prerectum, " single " guiding ring). Its position is doubtful also since the female is unknown. It is assigned tentatively to the oldest of both genera.

Genus **LAIMYDORUS** Siddiqi, 1969.

Laimydorus parhomalopapillatus (S. Stekhoven, 1944) n. comb.

Syn. *Dorylaimus parhomalopapillatus* S. Stekhoven, 1944.

(Figs. 10 and 11.)

Measurements. — Refer to Table 4.

Description. — Female: Body ventrally curved posterior to base of oesophagus, gradually tapering towards both extremities. Cuticle finely striated transversally, detached here and there from body. Lateral chords about 1/7th of the corresponding body width in the mid-body region. Numerous lateral body pores along the dorsal and ventral sides of the lateral chords. In addition to these there are two irregular rows of pores, one lateroventral, the other laterodorsal (Fig. 11 E). The lateroventral row consists of 30 pores, of which 8 in the oesophageal region and 22 more posterior reaching till the end of the posterior gonad. The laterodorsal row consists of 20 pores, of which 3 in the oesophageal region and 17 posterior to it, reaching up to the end of the posterior gonad. The dorsal body pores exceptionally reach till below the vulva.

Lip region wider than adjoining body, offset by a constriction. Lips angular in superficial view and bearing the usual number of papillae. Amphids deep, stirrup-shaped, slit occupying less than half of the corresponding body-width. Odontostyle 2.3 lip region widths long; aperture slightly less than half of odontostyle length. Guiding ring 1.4 lip region widths from anterior extremity.

Basal expanded portion of oesophagus occupying 57 % of neck length. Only the dorsal gland nucleus and outlet visible:

DO = 44.2 DN = 45.9

Cardia long, conoid, about half of the corresponding body width, enveloped by intestinal tissue. Prerectum about 7 anal body widths long; proximal part with prominent microvilli. Rectum about 1.3 anal body widths long.

Vulva appearing longitudinal. Vagina about half of the corresponding body width long, surrounded by a prominent sphincter. Polar bodies sometimes visible within the egg shell (Fig. 10 H).

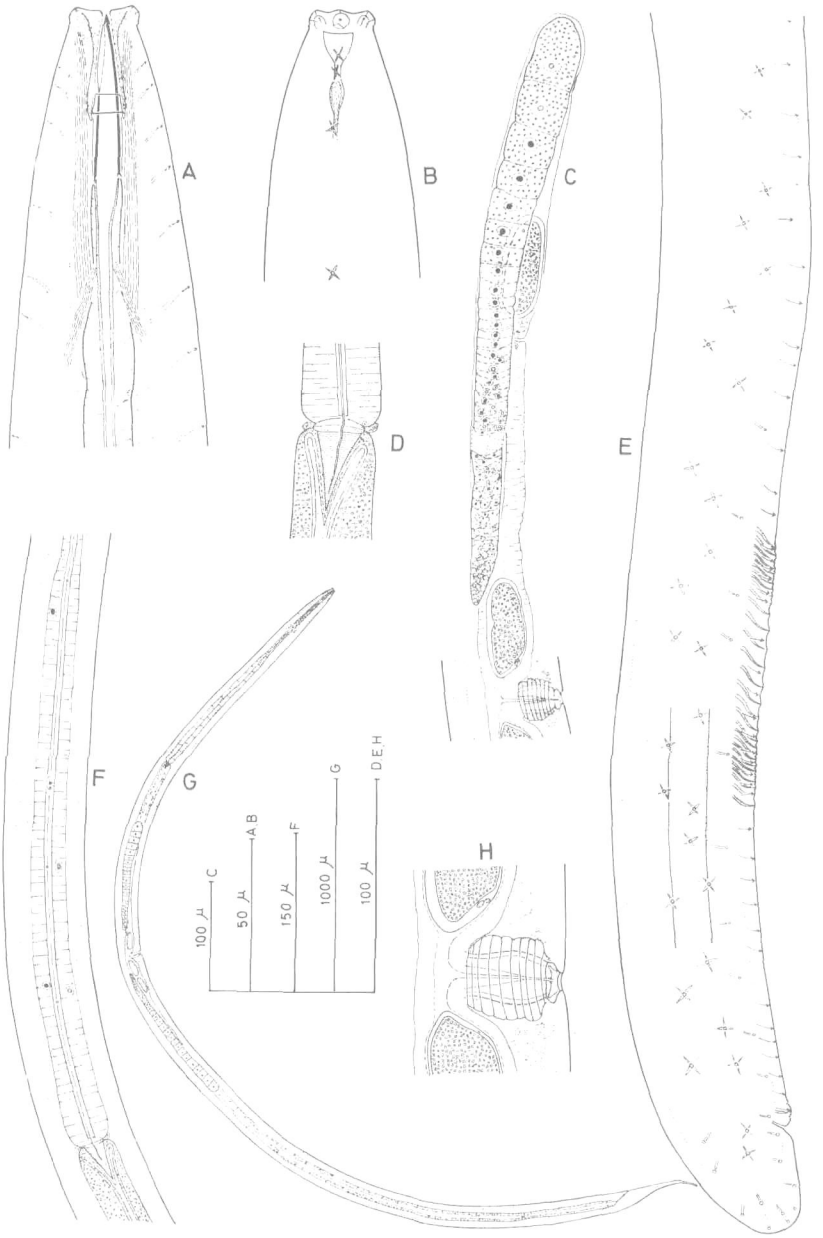

FIG. 10. — *Laimydorus parhomalopapillatus* (S. STEKHOVEN, 1944).

A : Anterior region; B : Surface view of anterior region; C : Female anterior gonad; D : Oesophago-intestinal junction, cardia; E : Surface view posterior body region of male, showing supplements, subventral papillae and lateral body pores; F : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; G : Entire female; H : Vulval region.

Tail elongate, tapering gradually, about 5 anal body widths long (tip broken); with 5 caudal pores on each side.

Male : Similar to female in general shape and morphology, except for the dissimilar tail. Lateral chords about 1/5th of body width in the mid-body. Lateral body pores numerous, along the dorsal and ventral side or in the middle (cf. Fig. 10 E) of the lateral chord. In the region of the prerectum the latero-ventral series of pores is quite far from the lateral chords; long ducts connect the pores with these chords.

Oesophageal gland nuclei and outlets well visible, positions as follows :

DO = 43.0-45.7	S_1O_1, S_1N_1 = 65-69
DN = 44.5-47.4	S_1O_2, S_1N_2 = 73-76
DO-DN = 1.5-1.7	S_2N = 84-86
	S_2O = 85-87
K = 68-80	K′ = 71-82

Male gonads typical. Spicules about 2 anal body widths long with a single median piece. Lateral guiding pieces well developed. Supplements consisting of an adanal pair and 25-29 ventromedians. The ventromedian ones are arranged in the following manner : first a group of 9-11 closely spaced, then 7-8 more widely spaced and finally again 9-10 closely spaced supplements. Subventral papillae irregularly spaced, reaching below or above the intestine-prerectum junction.

Prerectum 8-15 anal body widths long. Tail dorsally convex-conoid with broadly rounded tip about 3/4th of the anal body width long; with 10-11 caudal pores on each side.

Differential diagnosis. — *Laimydorus parhomalopapillatus* comes close to the type species *L. prolificus* (Thorne & Swanger, 1936) Siddiqi, 1969 but differs from it in the position of the vulva (V = 47 in *L. prolificus*), the length of the odontostyle (about 36 μ in *L. prolificus*) and the arrangement of the supplements. It also resembles *L. unipapillatus* (Daday, 1905) Andrássy, 1969, but differs by the odontostyle length (70 μ in *L. unipapillatus*) different arrangement of supplements and a-ratio (a = 30 in *L. unipapillatus*).

Type specimens. — Lectotype female mounted on slide *Laimydorus parhomalopapillatus* SS/49.

Paralectotypes : two males mounted on slides *Laimydorus parhomalopapillatus* SS/50-51.

Type locality and habitat. — From fresh water (N.A.P.), exact locality not known.

Remark. — S. Stekhoven (1944) described this species as *Dorylaimus parhomalopapillatus*, with 40-44 longitudinal lines. The original description is

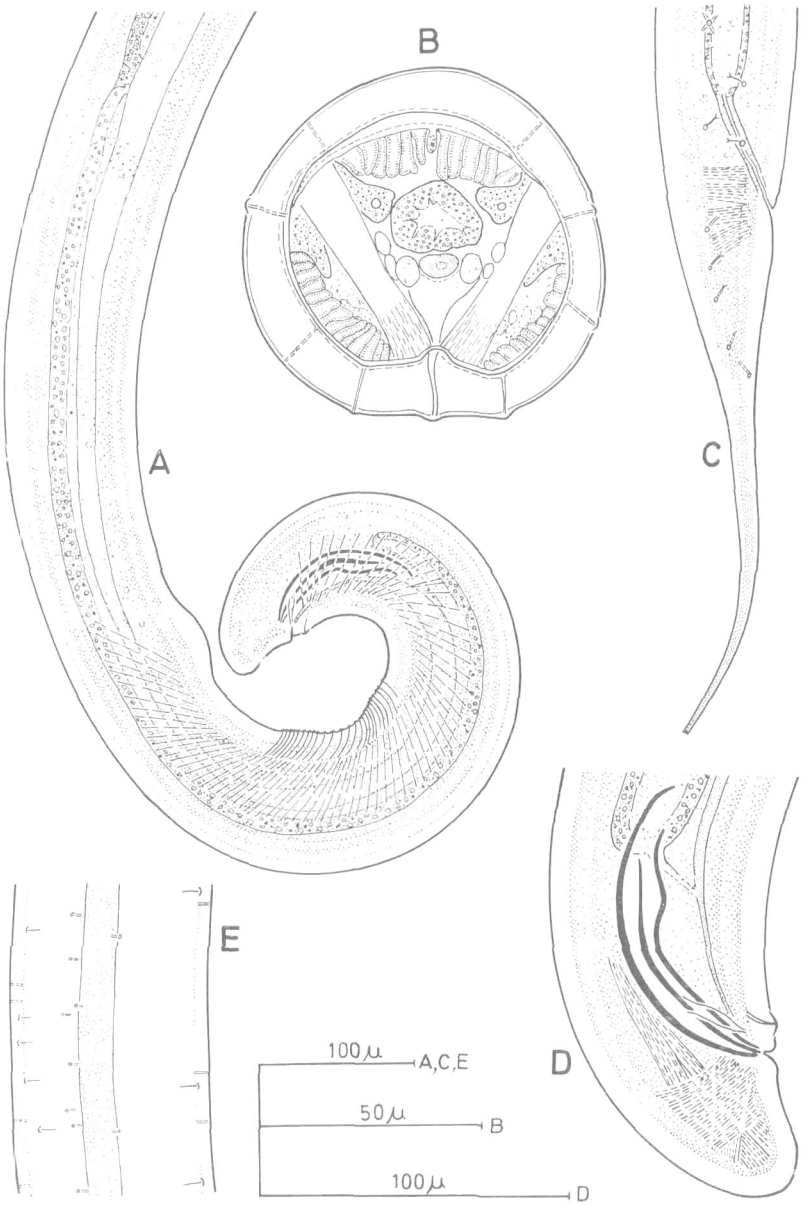

FIG. 11. — *Laimydorus parhomalopapillatus* (S. STEKHOVEN, 1944).

A : Posterior body region of male; B : Cross section through copulatory muscles region; C : Female tail; D : Male tail; E : Surface view in expanded portion of oesophagus, showing arrangement of body pores.

based on one female and two males but in the tube with type specimens an additional posterior fragment of a male was found. Since longitudinal lines could not be detected on any of the specimens in lateral view, a cross section was made of the fragment. This section shows that longitudinal lines are absent (Fig. 7 B), hence the species does not belong in *Dorylaimus*. It is here transferred to *Laimydorus* with which it agrees in many respects.

Laimydorus spec.

Syn. *Dorylaimus flavomaculatus* apud S. STEKHOVEN, 1944.

Nec *Dorylaimus flavomaculatus* v. LINSTOW, 1876

= *Laimydorus flavomaculatus* (v. LINSTOW, 1876) SIDDIQI, 1969.

(Fig. 12.)

S. STEKHOVEN (1944) reported two males and one female of *D. flavomaculatus* from Kimboko. The single male present in the collection was in rather good condition except for the head end.

Measurements. — Refer to Table 4.

Description. — Male: Body ventrally curved in posterior half, gradually tapering towards anterior end. Cuticle finely striated transversally. Lateral chords about 1/5th of the body width near middle. Body pores not visible. Lip region offset by slight constriction; about 1/3rd as wide as neck base. Exact shape of amphids not known.

Odontostyle probably 1.3 lip region widths long (junction with odontophore not clear!); aperture probably half of the odontostyle length. Two dark coloured, elongate bodies present in the odontophore region (Fig. 12 B). Guiding ring about one lip region width from anterior extremity, appearing " double ", but the stylet is protruded.

Basal expanded portion of oesophagus occupying 40 % of the neck region. Locations of oesophageal gland nuclei and orifices as follows:

DO = 62.5	S_1O_1, S_1N_1 = 81
DN = 63.9	S_1O_2, S_1N_2 = 83
DO-DN = 1.4	S_2N = 91
	S_2O = 92
K = 91	K′ = 92.4

Cardia cardiform, about 1/3rd of the corresponding body width. Prerectum about 5 anal body widths long.

Gonads typical. Spicules about 2.3 anal body widths long. Lateral guiding pieces well developed. Supplements consisting of an adanal pair and a contiguous series of 13 ventromedians. Subventral papillae irregularly spaced.

Tail conoid, dorsally convex, ventrally concave; with rounded terminus and with 4 caudal pores on each side.

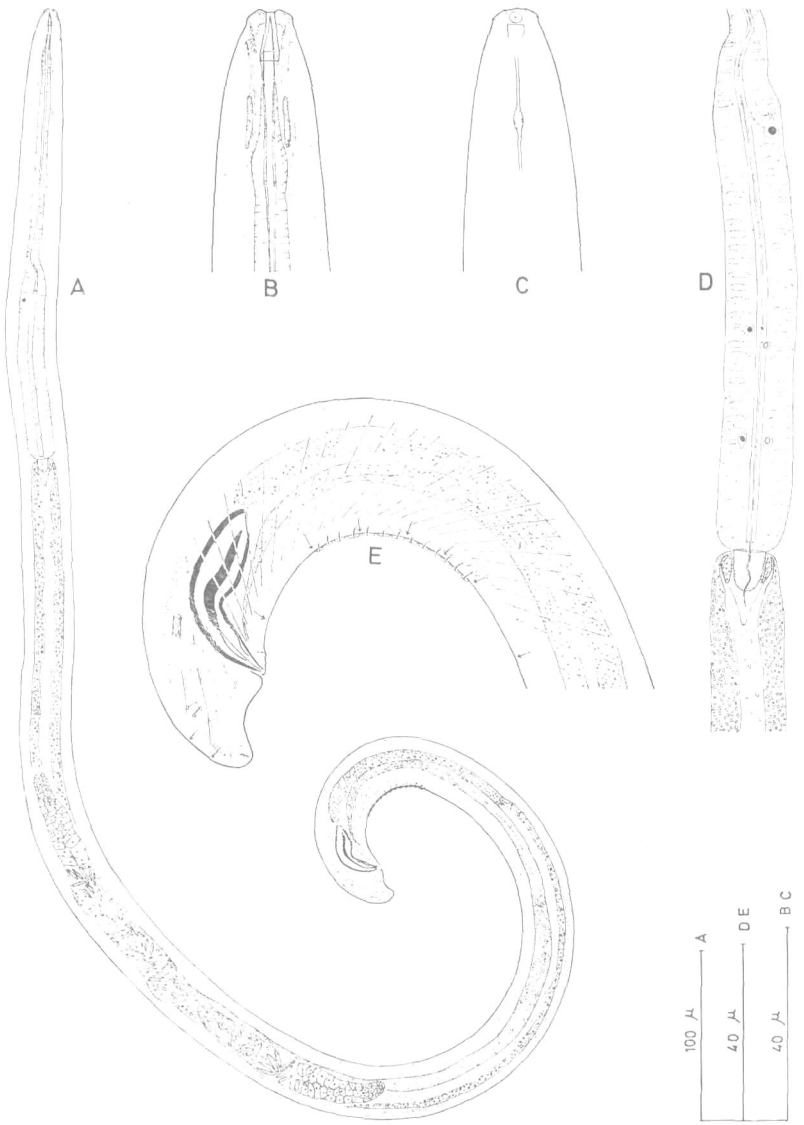

FIG. 12. — *Laimydorus* spec.

A : Entire male; B : Anterior region; C : Surface view of anterior region; D : Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; E : Posterior body region of male.

Locality and habitat. — Kimboho, bank of the lake.

Remarks. — Although S. STEKHOVEN (1944) reported a female he did not describe it. As no details about the female are known it is even more difficult to assign the present species to the correct genus. On the basis of the long prerectum and the contiguous ventromedian supplements of the male, it is tentatively placed in *Laimydorus*.

Genus **EUDORYLAIMUS** ANDRÁSSY, 1959.

Eudorylaimus granuliferus (COBB, 1893) ANDRÁSSY, 1959.

Syn. *Dorylaimus granuliferus* COBB, 1893.

(Fig. 13.)

This species was reported by S. STEKHOVEN & TEUNISSEN (1938) from three different localities. Now only the female from Visoke volcano is left. The specimen is damaged in the middle region of the body.

Measurements. — Refer to Table 5.

Description. — Female : Body ventrally curved in the posterior quarter of its length and tapering towards both extremities. Cuticle finely striated transversally, thickest on tail tip. Lateral chords about 1/5th of the body width behind the posterior gonad. Lateral body pores well visible but impossible to count in the damaged region.

Lip region angular distinctly offset by a deep constriction. Amphids stirrup-shaped; apertures occupying 2/3rd of the corresponding body width.

Odontostyle about 1.2 lip region widths long; aperture about half of the odontostyle length. Guiding ring about half the lip region width from anterior extremity.

Basal expanded portion of oesophagus occupying 46 % of the neck region. Because of too much flattening, the oesophageal gland nuclei and outlets are not clear. Cardia distorted. Junction of prerectum and intestine not distinct. Rectum about 1.5 anal body widths long.

Vulva a transverse slit. Vagina 19 µ long, with sclerotized distal part. Gonads amphidelphic; details not visible.

Tail about 1.4 anal body widths long; dorsally convex-conoid, with dorsally bent tip; bearing two caudal pores on each side.

Male : not found.

Locality and habitat. — Collected from an area with *Senecio, Lobelia* etc., around and inside the old crater of the Visoke volcano; Alt. at summit 3,770 m.

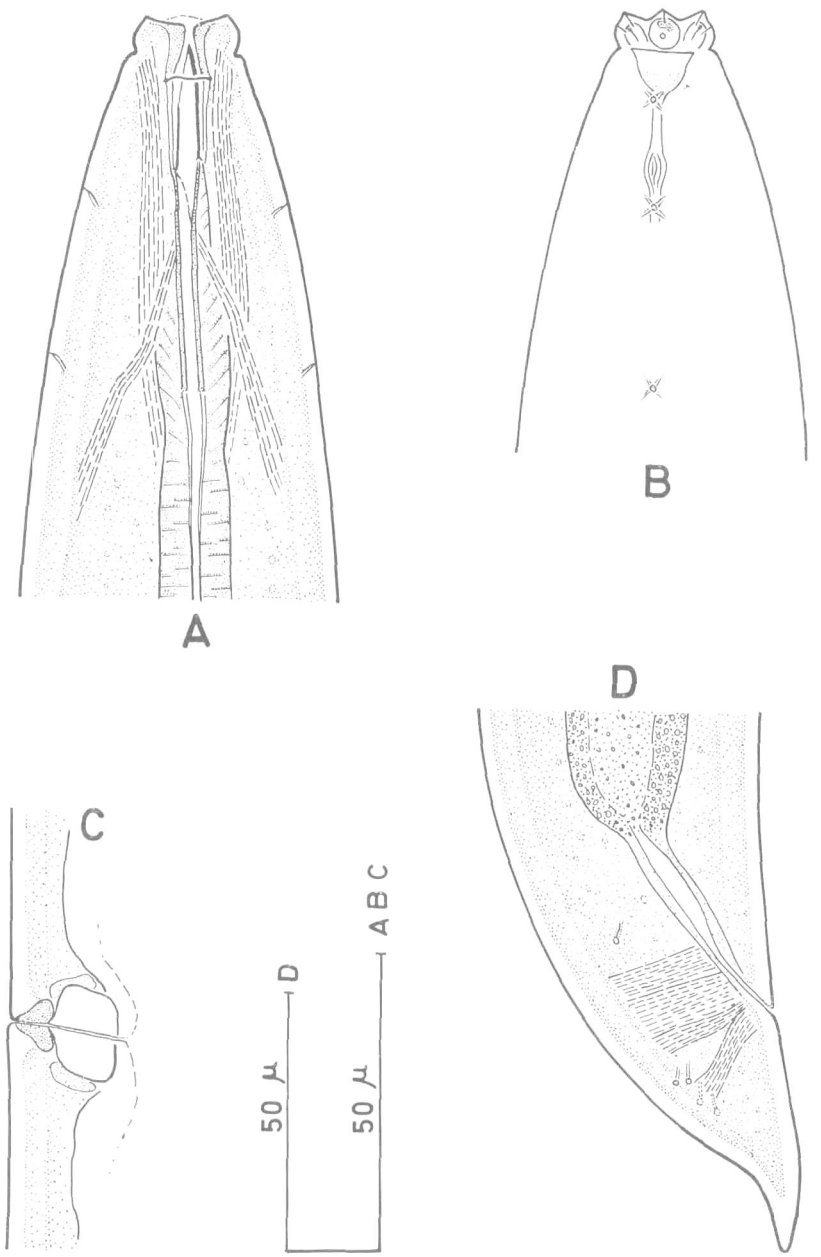

FIG. 13. — *Eudorylaimus granuliferus* (COBB, 1893) ANDRÁSSY, 1959.
A : Anterior region; B : Surface view of anterior region; C : Vulval region; D : Female tail region.

Eudorylaimus spec.

Syn. *Dorylaimus iners* apud S. STEKHOVEN & TEUNISSEN, 1938, ? partim.

Nec *Dorylaimus iners* BASTIAN, 1865

= *Eudorylaimus iners* (BASTIAN, 1865) ANDRÁSSY, 1959.

(Fig. 14.)

Measurements. — Refer to Table 5.

Description. — Female: Body ventrally curved, slightly tapering towards both ends. Cuticle finely striated transversally, thickest on tail tip. Lateral chords about 1/5th of body width near middle. Lateral body pores arranged along dorsal and ventral sides of lateral chords.

Lip region offset by a constriction. Lips angular, bearing the usual number of papillae. Amphids stirrup-shaped; apertures occupying about half of the corresponding body width.

Odontostyle about one lip region width long; its aperture not clear, but the conical part measures more than half of the odontostyle length. Guiding ring appearing " double " because of the protruded position of the stylet; fixed ring at about half the lip region width from anterior extremity.

Basal expanded portion of oesophagus about 45 % of the neck region. Locations of oesophageal gland nuclei and orifices as follows:

DO = 58.5	S_1O_1, $S_1N_1 = 78$
DN = 64.8	S_1O_2, $S_1N_2 = 80$
DO-DN = 6.3	$S_2N = 89$
	$S_2O = 91$
K = 90	K′ = 93

Cardia conoid with rounded tip, surrounded by intestinal tissue, about 1/5th of the corresponding body width long. Narrow oesophago-intestinal disc present. Prerectum slightly more than 1.5 and rectum slightly more than one anal body width long.

Vulva a transverse slit. Vagina extending about halfway into the body; with sclerotized distal part. Uteri nor oviducts countain sperms. Oocytes arranged in one to three rows.

Tail conoid, ventrally arcuate, with acute terminus; 1.7 anal body widths long; with 3 caudal pores on each side. Male: The specimen described by S. STEKHOVEN & TEUNISSEN (1938) is no longer available, so it cannot be checked wether it belonged to the same species. It was collected from a different locality (Molindi river).

Locality and habitat. — Kibga, southern slope of the Visoke volcano, near the margin of the bambou forest; Alt. 2,400 m.

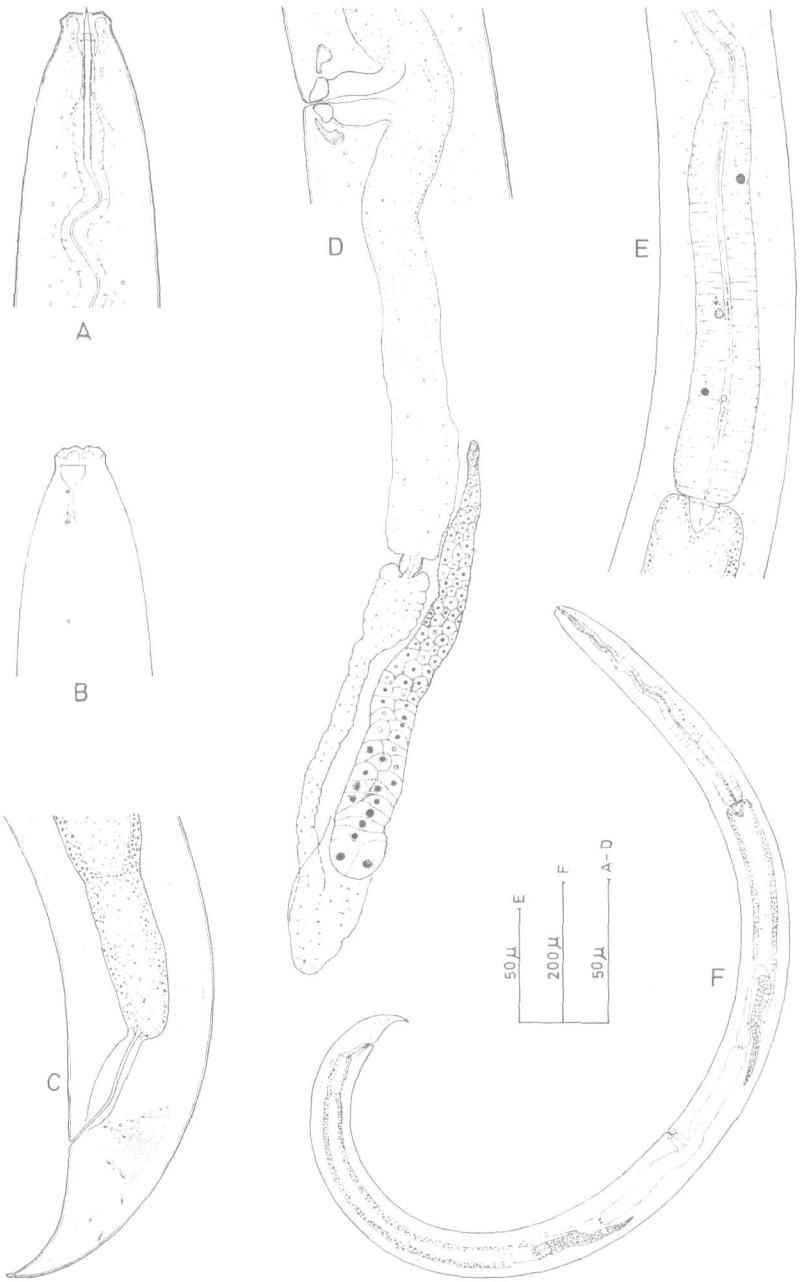

FIG. 14. — *Eudorylaimus* spec.

A : Anterior region; B : Surface view of anterior region; C : Posterior body region female; D : Female posterior gonad; E : Expanded portion of oesophagus, oesophageal gland nuclei and orifices; F : Entire female.

Remark. — The identification of S. STEKHOVEN & TEUNISSEN (1938) was apparently based on the male. The female shows several differences with *E. iners* and comes closer to *E. carteri* (BASTIAN, 1865) ANDRÁSSY, 1959. However, since only one specimen is available we do not assign it to any known species.

Genus **DISCOLAIMUS** THORNE, 1939.

Discolaimus major THORNE, 1939.

Syn. *Dorylaimus obtusicaudatus* apud S. STEKHOVEN & TEUNISSEN, 1938, partim.

Measurements. — Female (1): L = 2.23 mm; $a = 38$; $b = 3.9$; $c = 83$; $V = {}^{7}54^{8}$.

The specimens which were identified by S. STEKHOVEN & TEUNISSEN (1938) as *Dorylaimus obtusicaudatus* BASTIAN, 1865 include a single female of *Discolaimus major* from Rutshuru (sample no. 689). In this publication, figure 65 D probably shows the diagram of the head end of the same female.

Locality and habitat. — Collected from Rutshuru (vegetable garden of the Park); Alt. 1,285 m.

Genus **LONGIDORELLA** THORNE, 1939.

Longidorella multipapillata (S. STEKHOVEN & TEUNISSEN, 1938) SIDDIQI, 1962.

Syn. *Longidorus multipapillatus* S. STEKHOVEN & TEUNISSEN, 1938.

(Fig. 15.)

Measurements. — Holotype female: L = 0.63 mm; $a = 18$; $b = ?$; $c = 18$; $V = 61$.

Description. — Body slightly curved ventrally in posterior half, slightly tapering towards both ends. Cuticle finely striated, 2 μ thick below lip region, 3 μ in middle of body and 17 μ at tail tip. Lateral chords not visible because of distorted body.

Lip region well offset from body by deep constriction. Lips amalgamated. Amphids deep, stirrup-shaped with slit-like apertures; apertures 3 μ from anterior end, and 5 μ wide or about half of the corresponding body width.

Odontostyle 50 μ long or 5.5 times the lip region width. Odontophore not visible. Guiding ring not clear. Oesophagus and cardia distorted. Anterior limit of prerectum not discernible. Rectum 23 μ or about one anal body width long.

Vulva appears a transverse slit. Vagina 14 μ long, with sclerotized distal part. Other details of gonads no longer visible.

Tail elongate-conoid with rounded tip, 35 μ long or about 1.5 times the anal body width; with 2 caudal pores on each side.

Type specimen. — Holotype female mounted on slide SST/81.

Type locality and habitat. — Collected from Kibga, Southern slope of Visoke volcano, at the margin of the bambou forest; Alt. 2,400 m.

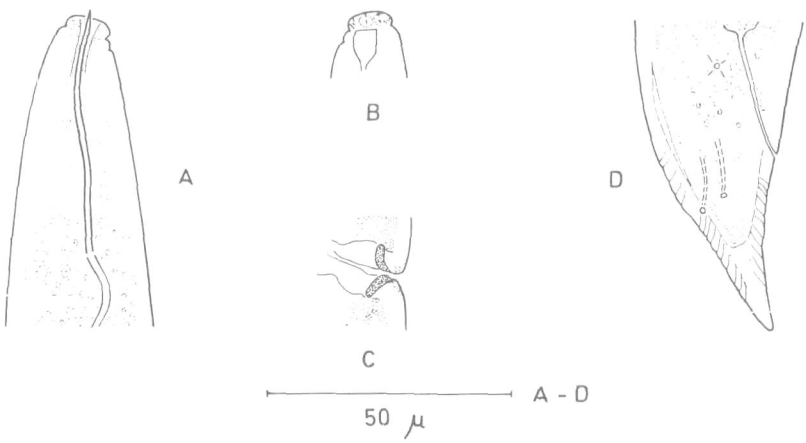

FIG. 15. — *Longidorella multipapillata* (S. STEKHOVEN & TEUNISSEN, 1938) SIDDIQI, 1962.

A : Anterior region; B : Head end in surface view; C : Vulva region; D : Tail region.

Remark. — S. STEKHOVEN & TEUNISSEN (1938) have reported many body pores. These pores are, in fact, very faint and not arranged as shown in their figure 59 A. In their figure 59 B, 9 caudal pores are drawn, but only two occur as described above.

Family APORCELAIMIDAE HEYNS, 1965

Genus **APORCELAIMELLUS** HEYNS, 1965.

A large number of specimens have been reported by S. STEKHOVEN & TEUNISSEN (1938) as *Dorylaimus obtusicaudatus* BASTIAN, 1865. For present study were available : 7 females from Kikere, 5 females from Kabara, 3 females from Mushumangabo, 2 females from Karisimbi, 1 female from Tshamugussa, 1 female from Tshumba, 1 from Nyakibumba and 1 from Rutshuru.

The specimen from Rutshuru appeared to be *Discolaimus major* (see above), that from Nyakibumba comes near to *Aporcelaimellus paracentrocercus* (De Coninck, 1935) n. comb. The identification of the other specimens as *A. obtusicaudatus* is confirmed.

S. Stekhoven & Teunissen (e.c.) also reported 3 females and a juvenile of *Dorylaimus granuliferus* Cobb, 1893. One of these females was present in the collection and after studying this the species is transferred to *Aporcelaimellus*.

Aporcelaimellus obtusicaudatus (Bastian, 1865) Altherr, 1968.

Syn. *Dorylaimus obtusicaudatus* Bastian, 1865.

Eudorylaimus obtusicaudatus (Bastian, 1865) Andrássy, 1959.

(Fig. 16.)

Measurements. — Refer to Table 6.

Description. — Female : Body robust, ventrally curved in posterior half, " C " shaped or irregularly curved. Cuticle finely striated transversally. Lateral chords 1/12th-1/9th of body width near middle. Lateral body pores irregularly spaced along dorsal and ventral side of lateral chords. Ventral body pores reaching up to the prerectum region; dorsal body pores restricted to anterior half of the neck region.

Lip region low and narrower than adjoining body, well offset by a constriction. Oral aperture hexagonal, but elongated along the dorsoventral axis. Amphids stirrup-shaped; aperture occupying more than half of the corresponding body-width.

Odontostyle about 1.1-1.4 lip region widths long; aperture more than half of the odontostyle length. Guiding ring irregular in outline, about 3/4th of the lip region width from anterior extremity.

Basal expanded portion of oesophagus occupying 48-58 % of neck region. Locations of oesophageal gland nuclei and orifices as follows :

DO = 47.0-57.0	S_1O_1, S_1N_1 = 66-71
DN = 49.9-60.6	S_1O_2, S_1N_2 = 75-80
DO-DN = 2.9-3.6	S_2N = 83-89
	S_2O = 84-90
K = 58-66	K′ = 65-72

Cardia short, hemispheroid, about 1/4th of the corresponding body width, enveloped by intestinal tissue. A narrow oesophago-intestinal disc present. Prerectum about 1.7-2.5 anal body widths long. Rectum more than one anal body width long.

Vulva a transverse slit. Vagina less than half of the corresponding body width; with sclerotized distal part. Gonads amphidelphic, short. Uterus and oviduct about equally long; without sperms.

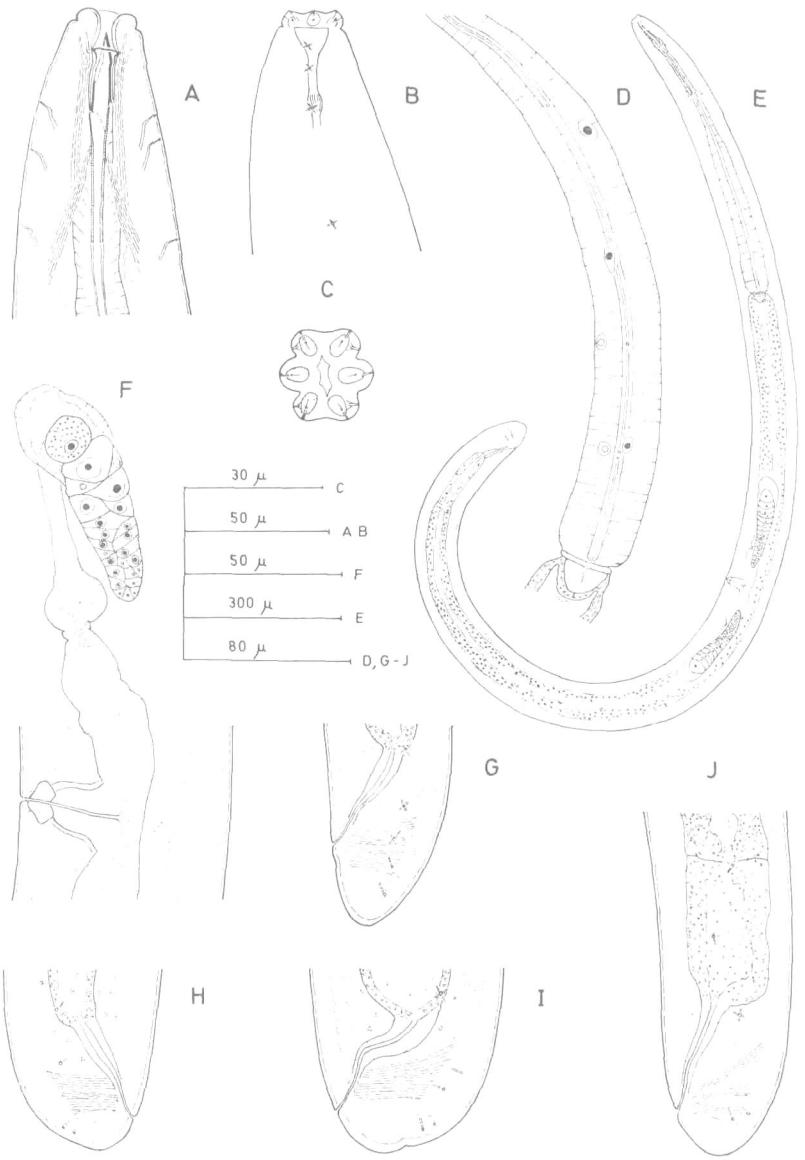

FIG. 16. — *Aporcelaimellus obtusicaudatus* (BASTIAN, 1865) ALTHERR, 1968.
A : Anterior region; B : Surface view of anterior region; C : *En face* view; D : Expanded portion of oesophagus, oesophageal gland nuclei and orifices; E : Entire female; F : Female anterior gonad; G-I : Female tail region; J : Posterior body region of female.

Tail showing a large variation in shape and length, from convex-conoid with rounded terminus to hemispheroid, sometimes notched; 1/3rd-2/3rd of the anal body width long; with two caudal pores on each side.

Male : not found.

Localities and habitats. — Collected from : (1) a swamp near Nyakibumba on the Western slope of the Mikeno volcano, Kikere; Alt. 2,226 m; (2) from a forest with *Hagenia* and *Hypericum* at Kabara, Mikeno-Karisimbi mountains; Alt. 3,200 m; (3) from Mushumangabo, Eastern slope of the Nyamuragira volcano; Alt. 2,075 m; (4) from Karisimbi volcano, lakes of the Southern slope, Ruanda, region with *Senecio, Lobelia,* etc.; Alt. 3,800 m; (5) from Tshamugussa, Bweza region, North-West of the Visoke, and Musule volcanos; Alt. 2,250 m; (6) from Tshumba, Mushari region, South-West of Rutshuru; Alt. 2,100 m.

Aporcelaimellus kikereensis sp. n.

Syn. *Dorylaimus obtusicaudatus* apud S. Stekhoven & Teunissen, 1938, partim.

(Fig. 17.)

In addition to the female specimen which was found in the collection of S. Stekhoven & Teunissen, two females from Nioka (Congo) were also studied.

Measurements. — Refer to Table 6.

Description. — Female : Body robust, ventrally curved slightly or totally, then " O "-shaped (Fig. 17 F), tapering slighter towards both ends. Cuticle finely striated transversally, thickest on tail tip. Lateral chords about 1/12th of the body width near middle. Lateral body pores start in a single row, after 5-6 pores they are arranged in an irregular double row along the ventral and dorsal sides of the lateral chords. Ventral body pores reaching up to the prerectum region; dorsal ones restricted anterior to the nerve ring.

Lip region low, narrower than adjoining body, well offset by a constriction; a faint line is visible between the lip region and the body. Amphids stirrup-shaped, divided into three parts by lines (Fig. 17 C); apertures occupying about half of the corresponding body width.

Odontostyle about 1.3-1.4 lip region widths long; aperture more than half of the odontostyle length. Guiding ring irregular in outline, about one lip region width from anterior extremity.

Basal expanded portion of oesophagus occupying 47-51 % of the neck region. Locations of oesophageal gland nuclei and orifices as follows :

DO = 51.7-55.4
DN = 55.8-59.0
DO-DN = 3.4-4.1

K = 60-66

S_1O_1, S_1N_1 = 65-68
S_1O_2, S_1O_2 = 72-75
S_2N = 84-85
S_2O = 85-86
K′ = 66-71

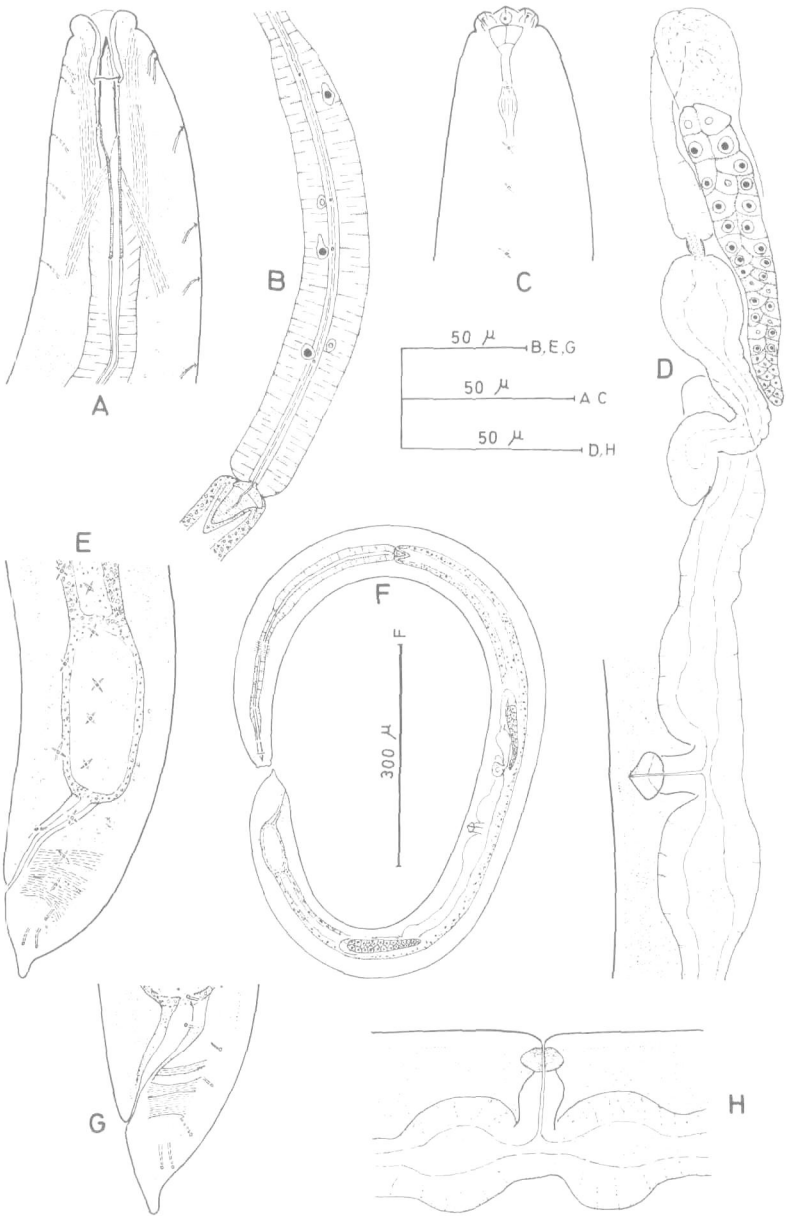

FIG. 17. — *Aporcelaimellus kikereensis* n. sp.

A : Anterior region; B : Expanded portion of oesophagus, oesophageal gland nuclei and orifices; C : Surface view of anterior region; D : Female anterior gonad; E : Posterior body region of female; F : Entire female; G : Female tail; H : Vulval region. (A-F : after holotype.)

Cardia conical, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum about 1-2 anal body widths long.

Vulva a transverse slit. Vagina about 1/3rd of the corresponding body width long, with moderately sclerotized distal region. Gonads amphidelphic. Uterus much longer than oviduct, convoluted, proximal and distal ends swollen and pocket-like. Sperms not seen. Oocytes arranged in one to three rows.

Tail convex conoid with a peg-like terminus; about one anal body width long; with 3 caudal pores on each side.

Male : not found.

Differential diagnosis. — *Aporcelaimellus kikereensis* n.sp. is closely related to *A. paracentrocercus* (De Coninck, 1935) n. comb. and *A. mamillatus* Williams, 1959) Heyns, 1965 (*) but differs mainly in vulva position (V = 51.4 in *A. paracentrocercus,* 45-54 in *A. mamillatus*) and body length (L = 1.875 in *A. paracentrocercus,* 1.5-2.1 in *A. mamillatus*).

Type specimens. — Holotype female from the S. Stekhoven collection on slide SST/69.

Paratype female on slide no. BC-N-91, Collection of the Instituut voor Dierkunde, Rijksuniversiteit Gent, Belgium.

Type locality and habitat. — Collected from Kikere, a swamp near Nyakibumba, Western slope of the Mikeno volcano; Alt. 2,226 m.

Other locality and habitat:

Soil around the roots of *Coffea arabica* L., *Sesbania sesban* (L.) and *Leucena pulverulenta* Benth, coffee plantation, former INEAC-station at Nioka.

Remark. — The specimen of the S. Stekhoven collection is selected as holotype for the following reasons :

1. It is in good condition.

2. One of the females from Nioka is in very good condition but has an atypical tail, the other female is in less good condition.

3. A type locality situated in a national park seems more suited for future collecting.

(*) *A. paracentrocercus* and *A. mamillatus* are very similar to each other and may be identical.

Family LONGIDORIDAE (THORNE, 1935) MEYL, 1961

Genus **LONGIDORUS** (MICOLETZKY, 1922) THORNE & SWANGER, 1936.

Longidorus congoensis Aboul-Eid, 1970.

Measurements. — Females (9) : L = 2.94-3.74 mm; a = 45-64; b = 8.3-9.5; c = 83-106; V = $^{5-8}$45-48$^{7-10}$; od. st. = 72-83 µ; od. ph. = 44-53 µ.

One of the tubes, labelled as 532-*Dorylaimus robustus,* contained specimens that agree fully with *Longidorus congoensis.*

S. STEKHOVEN & TEUNISSEN (1938, p. 144) did not mention at all about *Dorylaimus robustus* or a *Longidorus* species when giving the details of sample no. 532. Furthermore *D. robustus* was not reported from any locality in the 1938 nor in the 1944 publication. It is presumed that the authors made a preliminary identification of these nematodes but — for some reason — did not include them in their publication.

Sample 532 was collected at Thsamagussa, Bweza-region, South-West of the Visoke and Musule volcanos.

TABLE 1.

Measurements and diagnostic features of *Prodorylaimus* spec.

Species :	*P. paralongicaudatus*			*Prodorylaimus* spec.
Locality :	Tshumba		Mubiliba	Sesero
Specimens (No.)	1 ♂	1 ♀	1 ♀	2 ♀♀
L (mm)	2.48	2.64	2.85	2.30–2.87
a	40	38	40	35–38
b	4.7	5.0	6.0	4.3–4.9
c	4.9 (*)	3.1	3.2	8.7–8.8
V/T	49	37	40	43
G 1	—	10	11	12–14
G 2	—	12	11	11–18
cut. m. (μ)	4	4	4	2–3
cut. t. (μ)	7	8	8	3–5
lat. b. p.	66	62	—	88
oes.	18	20	—	24
ca. – prer.	32	33	—	51
prer. & r.	10	6	5	9
c. p.	8	3	3	4
vent. b. p.	23	24	—	41
dors. b. p.	4	4	—	18
A	3.4	3.3	—	3.5–4.3
B	2.6	2.6	—	2.1–2.2
amph. w. (μ)	10	10	—	8–9
od. st. (μ)	39	38	37	32
od. st. ap. (μ)	16	16	14	15–16
od. ph. (μ)	44	45	42	38–39
g. r. (μ)	23	24	23	21–22
prer. (μ)	163	92	113	126–161
r. (μ)	—	62	52	45–53
an. dia. (μ)	41	38	38	28–36
t. (μ)	505 (*)	845	895	265–325
nrv. r. (μ)	175	172	—	143–146
spic. (μ)	76	—	—	—
l. g. p. (μ)	18	—	—	—
supp.	20	—	—	—
s. v. p.	11	—	—	—
cop. mus.	49	—	—	—
sperm (μ)	3–4	—	—	—

TABLE 2.

Measurements and diagnostic features of *Dorylaimus* spec.

Species :	*D. stekhoveni* sp. n.			*Dorylaimus* spec.
Locality :	Gando			Kibga
Specimens (No.)	Holotype ♀	Paratypes (23 ♀♀) 10 ♀♀ (*)	Paratypes (21 ♂♂) 10 ♂♂ (*)	1 ♀
L (mm)	5.40	4.00–6.40	4.48–5.40	3.64
a	47	51–57	49–61	36
b	5.0	4.3–5.4	4.1–5.1	3.4
c	15	12–21	102–149	11
V/T	36	37–40	67–79	51
G 1	12	10–15	—	18
G 2	13	11–20	—	22
cut. m. (μ)	7	5–7	5–7	7
cut. t. (μ)	8	7–10	6–9	10
lat. b. p.	157	144–174	152–198	165
oes.	36	39–41	30–41	50
ca. – prer.	105	92–114	87–105	95
prer. & r.	13	11–16	25–40	16
c. p.	3	2–3	10–12	4
vent. b. p.	28	25–29	27–30	25
dors. b. p.	7	8–9	8–14	8
A	3	3.0–4.4	3.2–4.0	3.6
B	3	2.6–3.0	2.8–3.0	3.0
amph. w. (μ)	10	10–11	10–11	12
sens. (μ)	20	20–22	19–22	26
od. st. (μ)	55	53–57	53–58	68
od. st. ap. (μ)	23	22–26	22–25	28
od. ph. (μ)	60	57–62	57–62	78
g. r. (μ)	38	36–39	36–39	43
prer. (μ)	406	295–410	500–840	268
r. (μ)	75	68–90	6–8	75
an. dia. (μ)	56	47–68	49–62	52
t. (μ)	354	260–400	38–47	336
nrv. r. (μ)	240	220–280	230–275	280
egg (μ)	—	80–98 × 23–42	—	—
spic. (μ)	—	—	116–127	—
l. g. p. (μ)	—	—	20–22	—
supp.	—	—	55–62	—
s. v. p.	—	—	41–47	—
cop. mus.	—	—	82–94	—
sperm (μ)	—	—	7–10	—

(*) This number has been measured for all characteristic features.

TABLE 3.

Measurements and diagnostic features of *Mesodorylaimus* spec.

Species :	*M. ruwenzorii*	*M. effilatus*	*M. kamandeanus* sp. n.			*Mesodorylaimus* spec.
Locality :	Visoke Volcano	Kanyamenoni	Kamande			Tshengelero
Specimens (No.)	1 ♂	Holotype ♀	Holotype ♀	Paratypes 5 ♀♀	Paratypes 7 ♂♂	1 ♂
L (mm)	1.48	2.09	1.15	0.96–1.32	1.06–1.16	2.82
a	35	49	34	32–37	32–41	34
b	4.3	5.1	4.8	4.4–5.1	4.2–5.1	3.8
c	74	29	10	9–11	53–70	94
V/T	51	52	44	43–48	57–70	?
G 1	—	20	16	17–19	—	—
G 2	—	20	19	17–21	—	—
cut. m. (μ)	2	2	1	1–2	2	5
cut. t. (μ)	3	3	2	2	2	6
c. p.	5	2	2	2	3	11
A	3.2	2.9	3.1	3.2–3.9	3.1–3.6	4.0
B	2.0	2.1	2.5	2.2–2.5	2.2–2.5	3.1
amph. w. (μ)	5	6	3	3	3	7
sens. (μ)	18	—	12	11–12	11–13	25
od. st. (μ)	16	16	13	11–13	12–13	38
od. st. ap. (μ)	6	6	4	4–6	4–6	15
od. ph. (μ)	24	25	15	15–17	15–17	57
g. r. (μ)	10	9	9	8–9	8–9	23
prer. (μ)	100	67	68	52–80	125–186	208
r. (μ)	—	47	32	27–35	—	—
an. dia. (μ)	27	24	16	16–19	19–24	46
t. (μ)	22	70	118	98–138	17–20	30
nrv. r. (μ)	113	139	93	90–106	100–110	—
egg (μ)	—	73–86 × 30–33	87 × 24	—	—	—
spic. (μ)	48	—	—	—	47–49	90
l. g. p. (μ)	8	—	—	—	7–8	17
supp.	7	—	—	—	18–21	27
s. v. p.	7	—	—	—	7–8	11
cop. mus.	29	—	—	—	31–37	58
sperm (μ)	9–10	—	11–14	—	11–14	8–9

TABLE 4.

Measurements and diagnostic features of *Laimydorus* spec.

Species :	*L. parhomalopapillatus*		*Laimydorus* sp.
Locality :	?		Kimboho
Specimens (No.)	1 ♀	2 ♂♂	1 ♂
L (mm)	5.40	3.60–4.55	1.16
a	50	41–48	36
b	4.7	3.8–4.5	4.4
c	13 ?	83–120	55
V/T	40	58	63
G 1	12	—	—
G 2	13	—	—
cut. m. (μ)	9	5–6	1
cut. t. (μ)	14	6–7	2
lat. b. p.	191	145–196	—
oes.	44	33–47	—
ca. – prer.	124	73–94	—
prer. & r.	18	29–44	—
c. p.	5	10–11	4
vent. b. p.	44	63–72	—
dors. b. p.	30	11–14	—
A	4.5	4.2–4.8	3.3
B	3.3	2.7–3.3	2.2
amph. w. (μ)	10	10–11	4
sens. (μ)	20	19–21	17
od. st. (μ)	53	52–53	± 12
od. st. ap. (μ)	25	24–25	± 6
od. ph. (μ)	55	55–56	± 19
g. r. (μ)	32	34	9
prer. (μ)	440	418–790	122
r. (μ)	82	—	—
an. dia. (μ)	64	51–42	18
t. (μ)	335	38–44	21
nrv. r. (μ)	260	204–233	102
egg (μ)	85–95 × 33–43	—	—
spic.(μ)	—	100–105	42
l.g.p. (μ)	—	20–22	8
supp.	—	25–29	13
s. v. p.	—	38–41	7
cop. mus.	—	75–81	26
sperm (μ)	—	—	8–11

TABLE 5.

Measurements and diagnostic features of *Eudorylaimus* spec.

Species :	*E. granuliferus*	*Eudorylaimus* spec.
Locality :	Visoke Volcano	Kibga
Specimens (No.)	1 ♀	1 ♀
L (mm)	1.65	1.80
a	31	26
b	4.3	4.8
c	34	29
V/T	50	51
G 1	13	15
G 2	15	18
cut. m. (μ)	2	3
cut. t. (μ)	11	6
lat. b. p.	?	42
oes.	8	7
ca. – prer.	—	27
prer. & r.	—	5
c. p.	2	3
vent. b. p.	21	—
dors. b. p.	4	—
A	—	3.3
B	3.0	2.7
amph. w. (μ)	11	8
sens. (μ)	18	17
od. st. (μ)	21	17
od. st. ap. (μ)	10	?
od. ph. (μ)	37	36
g. r. (μ)	10	10
prer. (μ)	—	57
r. (μ)	43	42
an. dia. (μ)	34	36
t. (μ)	48	62
nrv. r. (μ)	149	123

TABLE 6.

Measurements and other characteristic features of *Aporcelaimellus* spec.

Species :	*A. obtusicaudatus*		*A. kikereensis*	
Locality :	Kikere	Kabara	Kikere	Nioka
Specimens (No.)	6 ♀♀	5 ♀♀	Holotype	Paratype 2 ♀♀
L (mm)	1.45–2.35	1.86–2.36	1.45	1.10–1.37
a	21–26	25–35	20	18–21
b	3.0–4.1	3.4–4.5	3.6	3.2–3.4
c	67–105	93–119	50	37–42
V/T	48–57	48–57	60	61
G 1	9–12	6–17	14	15–17
G 2	9–12	8–15	18	17–18
cut. m. (μ)	3–5	3–5	3	3
cut. t. (μ)	8–13	8–11	8	10–13
lat. b. p.	54–79	49–74	105	91–98
oes.	16–21	14–20	29	25–27
ca. – prer.	33–49	30–45	63	56–60
prer. & r.	4–7	3–7	10	7–8
c. p.	2	2	3	3
vent. b. p.	40–49	35–46	8	55
dors. b. p.	8–10	7–10	7	7–8
A	3.5–4.2	3.2–3.8	4.0	3.0
B	3.5–4.0	3.3–4.0	3.8	3.1–3.7
amph. w.	10–11	10–11	10	9
sens. (μ)	22–24	22–24	22	20–21
od. st. (μ)	22–26	21–25	26	26–28
od. st. ap. (μ)	13–16	13–15	15	15–16
od. ph. (μ)	40–47	42–48	37	34–42
g. r. (μ)	11–13	11–13	18	16–18
prer. (μ)	88–137	70–145	67	33–37
r. (μ)	53–68	49–65	48	50
an. dia. (μ)	50–60	42–50	35	33
t. (μ)	18–42	18–22	30	30–36
nrv. r. (μ)	133–193	140–157	143	124–138
egg (μ)	105–115 × 45–49	—	—	—

SUMMARY

The representatives of the families DORYLAIMIDAE and APORCELAIMIDAE described by S. STEKHOVEN & TEUNISSEN (1938) and S. STEKHOVEN (1944) are redescribed. The specimens available for study have been identified as belonging to 8 genera and to 16 species, three of them being new, *Dorylaimus stekhoveni* sp. n., *Mesodorylaimus kamandeanus* sp. n. and *Aporcelaimellus kikereensis* sp. n. Five new combinations are proposed, *Ischiodorylaimus maximodorus* (S. STEKHOVEN & TEUNISSEN, 1938) comb. n., *Mesodorylaimus effilatus* (S. STEKHOVEN & TEUNISSEN, 1938) comb. n., *Laimydorus parhomalopapillatus* (S. STEKHOVEN, 1944) comb. n., *Laimydorus cryptosperma* (LOOF, 1969) comb. n. and *Aporcelaimellus paracentrocercus* (DE CONINCK, 1935) comb. n.; two species are considered as species inquirendae, *Dorylaimus lentifer* S. STEKHOVEN & TEUNISSEN, 1938 and *Ischiodorylaimus maximodorus* (S. STEKHOVEN & TEUNISSEN, 1938). The diagnostic value of some characters used for differentiating the genera *Mesodorylaimus* and *Laimydorus* is discussed. Finally the occasional finding of *Longidorus congoensis* ABOUL-EID, 1970 is reported.

ALPHABETIC LIST OF FAMILIES, GENERA AND SPECIES

FAMILIES.

GENERA.

SPECIES.

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NEMATODES OF HIGH ALTITUDES IN INDIA

V. FIVE NEW SPECIES OF THE GENUS *ENCHODELUS* THORNE, 1939 (DORYLAIMIDA)

BY

QAISER H. BAQRI AND M. SHAMIM JAIRAJPURI

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Enchodelus thorbei n. sp. 1.28-1.67 mm long; odontostyle 16-18 μm; odontophore 24-28 μm; tails in both sexes arcuate-conoid. *Enchodelus satendri* n. sp. 1.38-1.88 mm long; odontostyle 25-30 μm; odontophore 34-40 μm; tails in both sexes short conoid, ventrally curved in posterior one-third. *Enchodelus maximus* n. sp. 2.48-2.60 mm long, odontostyle 54-57 μm; odontophore 53-56 μm; tail conoid ventrally curved. *Enchodelus parateres* n. sp. 1.20-1.57 mm long; odontostyle 21-22 μm; odontophore 23-28 μm; tails in both sexes short, bluntly-conoid or hemispheroid. *Enchodelus microdoroides* n. sp. 1.09-1.24 mm long; odontostyle 40-42 μm; odontophore 43-47 μm; tail short, convex-conoid. *Enchodelus longidens* Jairajpuri & Loof, 1968 has also been recorded. A key to the genus *Enchodelus* is given.

A survey of the plant and soil nematodes of the Himalaya mountains in Himachal Pradesh yielded *Enchodelus longidens* Jairajpuri & Loof, 1968 and five new species of the genus *Enchodelus*. The specimens were fixed in hot 4 % formalin, dehydrated slowly in a desiccator and mounted in dehydrated glycerine. The type material of the five newly described species of *Enchodelus* was collected by M. Shamim Jairajpuri in October, 1970 and is in the nematode collection of Zoology Department, Aligarh Muslim University, Aligarh (U.P.), India.

ENCHODELUS THORNEI N. SP.

(Fig. 1)

Measurements: See Table I.

Description:

Female: Body tapering gradually in neck region, in posterior half curved ventrally on fixation. Cuticle finely striated, thickest on tail tip (14-16 μm). Lateral chords 1/5th-1/4th of body-width near midbody. Dorsal, ventral, and lateral body pores not distinct.

Lip region set off from body, about 1/4th-1/3rd body-width at base of oesophagus. Amphids cup-shaped, curved slit-like apertures occupying less than 1/2 of corres-

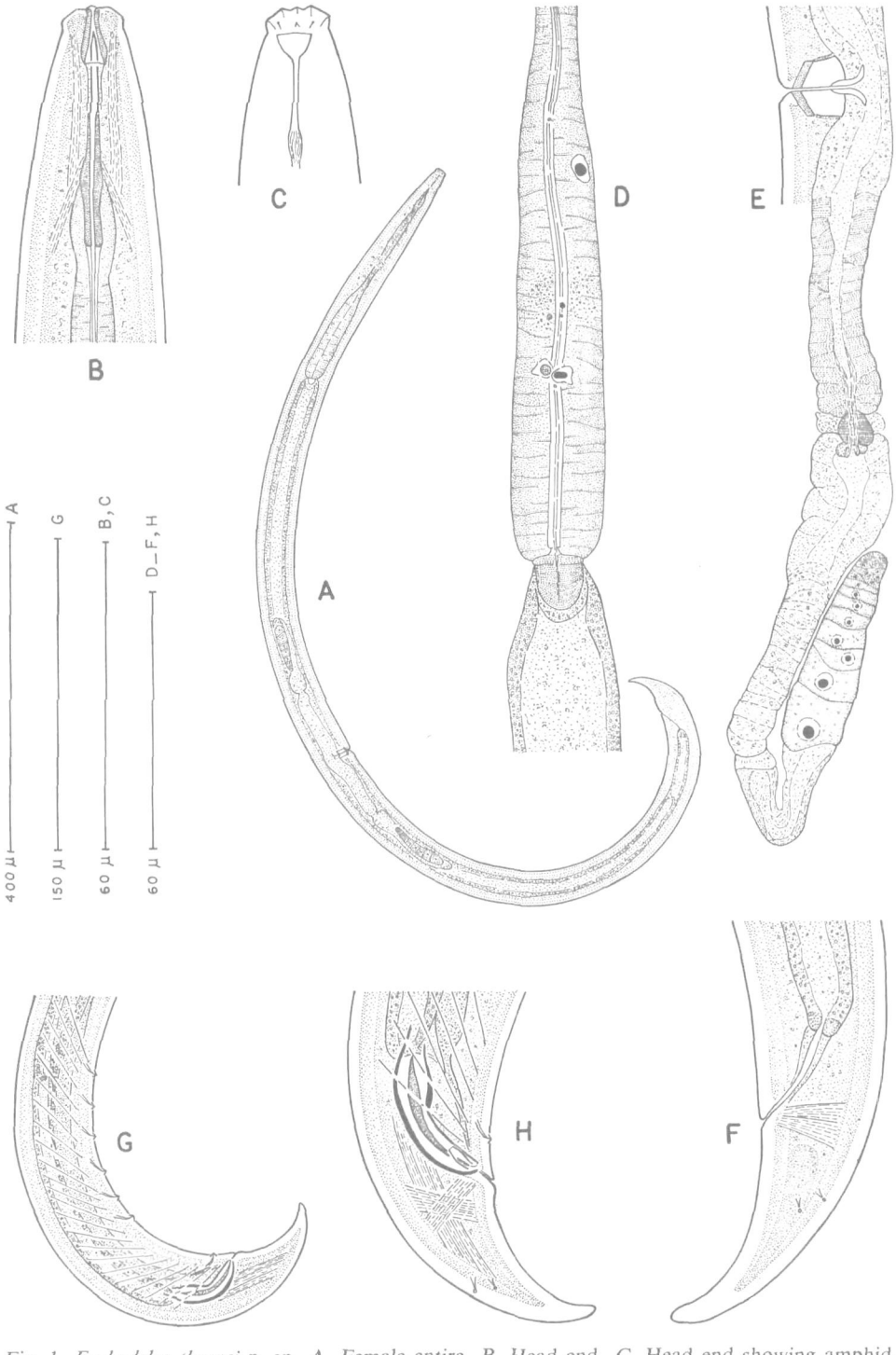

Fig. 1. *Enchodelus thornei* n. sp. A. Female entire, B. Head end, C. Head end showing amphid, D. Expanded region of oesophagus, E. Posterior female sexual branch, F. Female tail end, G & H. Male tail ends.

ponding body-width. Odontostyle 1.4-1.6 head-widths long; its aperture about 1/8th of odontostyle length. Guiding ring 1.0-1.2 head-widths from anterior end. Odontophore 1.5-1.7 times the odontostyle length.

Basal expanded portion of oesophagus 37-40 % of neck region. The location of the oesophageal gland nuclei and their orifices given in Table II. Nerve ring surrounding anterior slender part of oesophagus at 41-44 % of neck length from anterior end. Cardia rounded, tongue-shaped, surrounded by intestinal tissues. Oesophago-intestinal disc present. Prerectum 2.8-4.8, and rectum about one, anal body-width(s) long.

Vulva a transverse slit. Vagina extending inwards, about 2/5-1/2 of corresponding body-width long, encircled proximally by cuticularization. Gonads amphidelphic. Uterus divided into a proximal glandular and a distal muscular part. Oviduct and uterus separated by well developed sphincter. Ovaries reflexed; oocytes arranged in single row except in growth region.

Tail 1.9-2.3 anal body-widths long, with 2 caudal pores on each side, ventrally arcuate-conoid, terminus rounded.

Male: A single male was found from Nagar, district Kulu. Morphologically this is similar to females of the type population. Supplements consist of an adanal pair and 6 ventromedians, the latter spaced nearly at regular intervals. Spicules about 1.6 anal body-widths along median axis. Lateral guiding pieces slightly less than 1/4th anal body-width. Copulatory muscle bands occupying the area up to last ventromedian supplement. Subventral papillae not seen. Prerectum 4.8 anal body-widths long, starting between the level of 5th and 6th ventromedian supplements.

Type habitat and locality: Soil around roots of unidentified grasses from Rohtang Pass (altitude approx. 14,000 ft.), district Kulu, H.P.

The male from soil around roots of deodar, *Cedrus deodara*, Nagar (altitude approx. 5,800 ft.), district Kulu, H.P.

Type specimens: Holotype mounted on slide H.A.5/*Enchodelus thornei*/1, paratypes mounted on slides H.A.5/*Enchodelus thornei*/2-6.

Male specimen mounted on slide H.A.10/*Enchodelus thornei*/7.

Differential diagnosis: *Enchodelus thornei* n. sp. comes close to *E. arcuates* Thorne, 1939 and *E. magnificus* (Altherr, 1952) Altherr, 1963. It differs from *E. arcuatus* in having differently shaped amphids, flanged odontophore (odontophore without flanges in *E. arcuatus*), expanded part of oesophagus 37-40 % (expanded part about 50 % in *E. arcuatus*), and rectum about 1/2 of tail length (rectum about one tail length in *E. arcuatus*), and from *E. magnificus* by having differently shaped lip region, wider odontostyle, flanged odontophore (odontophore without flanges in *E. magnificus*), and a differently shaped uterus-oviduct junction. It can further be differentiated from *E. magnificus* by the absence of cutinized pieces around the oral aperture.

ENCHODELUS SATENDRI N. SP.
(Fig. 2)

Measurements: See Table I.

Description:

Female: Body tapering gradually in neck region, becoming curved, more ventrally on fixation, more strongly so in posterior half. Cuticle with fine striations, its thickness 15-22 μm on tail tip. Lateral chords 1/8th-1/5th of body-width near midbody. Dorsal, ventral, and lateral body pores indistinct.

Lip region set off from body, 1/4-2/7 body-width at base of oesophagus. Amphids cup-shaped, curved slit-like apertures occupying 2/5th-2/3rd of corresponding body-width. Odontostyle 1.9-2.1 head-widths long; its aperture 1/12th-1/9th of odontostyle length. Guiding ring 1.2-1.4 head-widths from anterior end. Odontophore 1.3-1.5 times the odontostyle length.

Basal expanded portion of oesophagus 34-37 % of neck length. The location of the oesophageal gland nuclei and their orifices are given in Table II. Nerve ring surrounding anterior slender part of oesophagus at 43-48 % of neck from anterior end. Cardia hemispheroid, surrounded by intestinal tissues. Oesophago-intestinal disc present. Prerectum 2.0-3.6, and rectum 1.0-1.2 anal body-width(s) long.

Vulva a transverse slit. Vagina extending 2/5-1/2 across the body, encircled proximally by cuticularization. Gonads amphidelphic. Uterus divided into a proximal glandular and a distal muscular part. Oviduct and uterus distinctly separated by sphincter. Ovaries reflexed; oocytes arranged in single row except in growth region.

Tail 1.5-1.9 anal body-widths long, conoid, terminus rounded, slightly ventrally curved in posterior 1/3rd, with 2-3 caudal pores on each side.

Male: Supplements consist of an adanal pair and 4-6 ventromedians, the latter spaced nearly at regular intervals. Spicules 1.4-1.6 anal body-widths along median axis. Lateral guiding pieces well developed. Copulatory muscle bands occupying the area up to slightly above the region of ventromedian supplements. Subventral papillae indistinct. Prerectum 3.7-4.3 anal body-widths long.

Type habitat and locality: Soil from the Sulphur springs, near Vashisht Temple, Vashisht, Manali (altitude approx. 6,000 ft.), district Kulu, H.P.

Specimens from Rohtang Pass were collected from soil around roots of unidentified grasses, district Kulu, H.P.

Type specimens: Holotype female along with one paratype male mounted on slide H.A.4/*Enchodelus satendri*/1; paratypes mounted on slides H.A.4/*Enchodelus satendri*/2-4.

Specimens from Rohtang Pass mounted on slides H.A.5/*Enchodelus satendri*/5-6.

Differential diagnosis: *Enchodelus satendri* * n. sp. comes close to *E. constrictus* Jairajpuri & Loof, 1968 and *E. rhaeticus* Altherr, 1952. It differs from the former

* Named after Dr. Satendra Khera, Deputy Director, Zoological Survey of India, Calcutta.

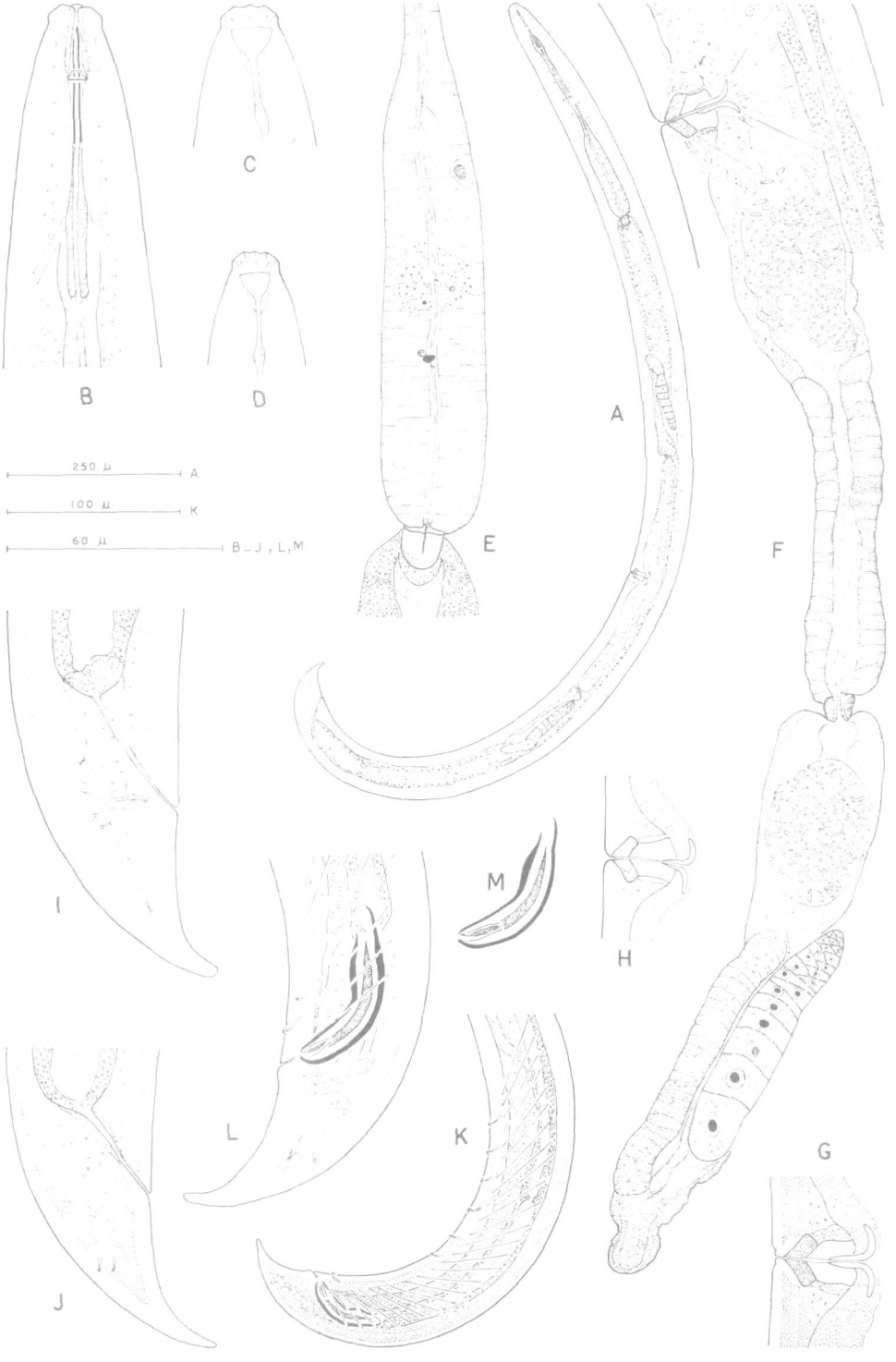

Fig. 2. *Enchodelus satendri* n. sp. A. Female entire, B. Head end, C & D. Head ends showing amphid, E. Expanded region of oesophagus, F. Posterior female sexual branch, G & H. Vulva region, I & J. Female tail ends, K & L. Male tail ends, M. Spicule.

in having a differently shaped lip region and amphids, longer odontostyle (odontostyle 23-24 μm long in *E. constrictus*), longer and flanged odontophore (odontophore 29-31 μm long without flanges in *E. constrictus*), differently shaped spicules and lateral guiding pieces, and ventromedian supplements arranged nearly at regular intervals and, from *E. rhaeticus* in differently shaped lip region and amphids, longer odontostyle (odontostyle 22 μm in *E. rhaeticus*), longer and flanged odontophore (odontophore 32 μm long without flanges in *E. rhaeticus*), and a more posteriorly situated vulva (V = 41 in *E. rhaeticus*).

ENCHODELUS MAXIMUS N. SP.

(Fig. 3)

Measurements: See Table I.

Description:

Female: Body tapering slightly in neck region, posterior half curving ventrally on fixation. Cuticle finely striated, its thickness 20-23 μm on tail tip. Lateral chords about 1/4th of body-width near midbody. Dorsal, ventral and lateral body pores indistinct.

Lip region set off from body, about 1/4th body-width at base of oesophagus. Amphids cup-shaped, irregularly curved slit-like apertures occupying about 3/4th of corresponding body-width. Odontostyle 3.5-3.6 head-widths long; its aperture about 1/20th of odontostyle length. Guiding ring about 2.3 head-widths from anterior end. Odontophore about equal to odontostyle length.

Basal expanded portion of oesophagus about 37 % of neck length. The location of the dorsal oesophageal gland nucleus and first pair of subventral oesophageal gland nuclei and their orifices given in Table II. The second pair of subventral oesophageal gland nuclei and their orifice not visible. Nerve ring surrounding anterior slender part of oesophagus at 42-43 % of neck length from anterior end. Cardia rounded, surrounded by intestinal tissues. Prerectum 5.0-5.6, and rectum about one anal body-width(s) long.

Vulva a transverse slit. Vagina extending about 2/5 of width across the body, encircled at proximal end by cuticularization and at distal end by sphincter. Gonads amphidelphic. Uterus divided into a proximal glandular and a distal muscular part. Oviduct and uterus distinctly separated by sphincter. Spindle-shaped sperms present in uterus and oviduct. Ovaries reflexed; oocytes arranged first in single, then in double rows.

Tail 1.8-1.9 anal body-widths long, conoid, ventrally curved, with 2 caudal pores on each side, terminus rounded.

Male: Not found.

Type habitat and locality: Same as *E. thornei*.

Type specimens: Holotype mounted on slide H.A.5/*Enchodelus maximus*/1, paratype on slide H.A.5/*Enchodelus maximus*/2.

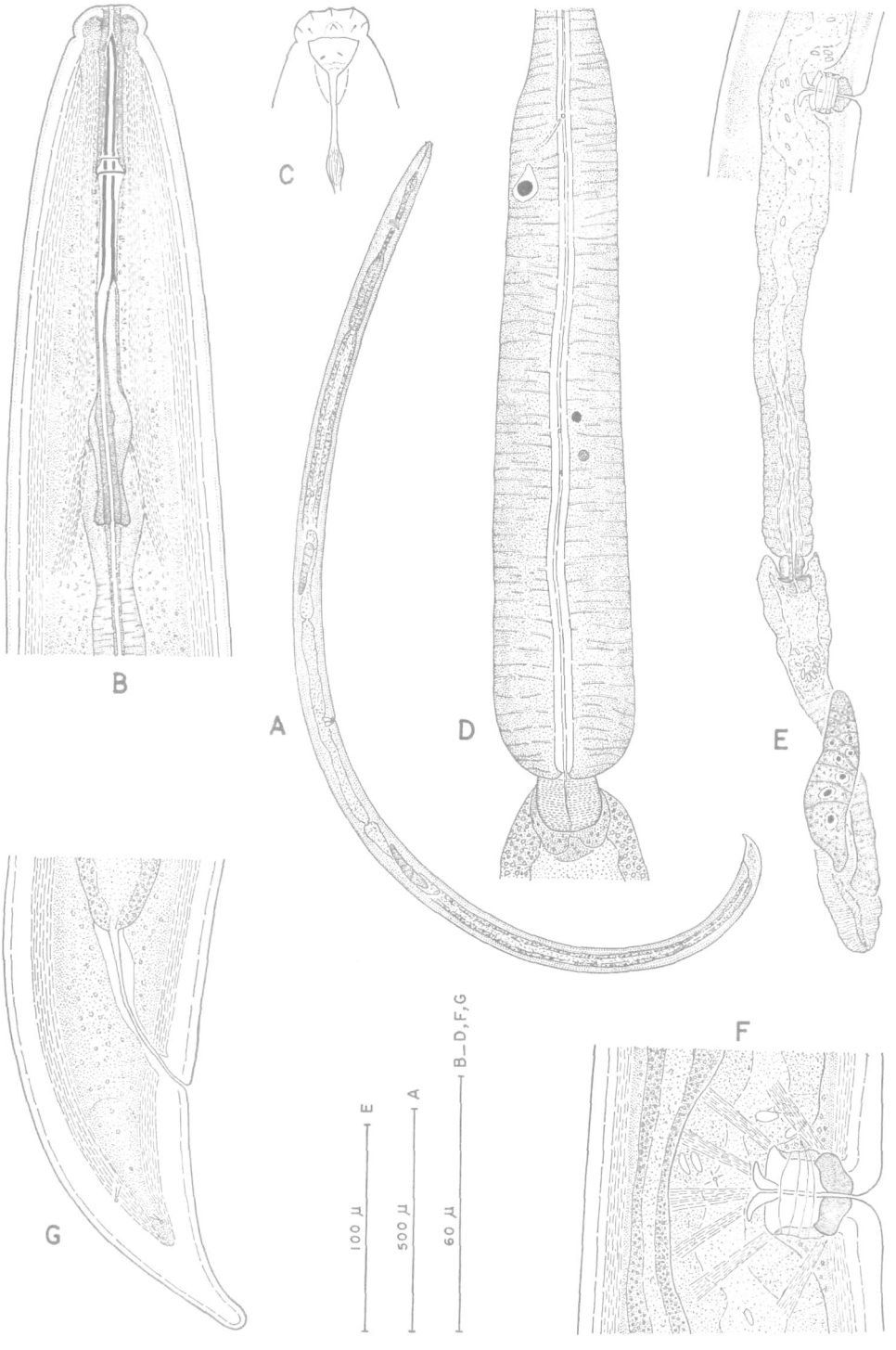

Fig. 3. *Enchodelus maximus* n. sp. A. Female entire, B. Head end, C. Head end showing amphid, D. Expanded region of oesophagus, E. Posterior female sexual branch, F. Vulva region, G. Female tail end.

TABLE I *Measurements of five new*

Measurements	*Enchodelus thornei* n. sp.			*Enchodelus satendri* n. sp.		
	Rohtang Pass Population (Type)		Nagar Population	Vashisht Population (Type)		
	Holotype ♀	Paratypes ♀♀ (10)	(Type) ♂ (1)	Holotype ♀	Paratype ♀♀ (5)	Paratypes ♂♂ (6)
L (mm)	1.62	1.28-1.67	1.43	1.62	1.53-1.88	1.38-1.57
a	33	30-37	51	29	27-29	25-30
b	5.2	4.8-5.3	5.4	5.5	5.2-6.3	5.0-6.0
c	29	23-29	28	36	26-35	24-32
V or T	50	48-54	53	52	49-53	66-71
G_1 (%)	10.7	10-12	—	17	18-21	—
G_2 (%)	10.7	8-12	—	17	18-21	—
Cuticle thickness midbody (μm)	2	2	2	3	2-3	2-3
Cuticle thickness tail (μm)	4	3-4	4	5	5-6	5
Lip region width (μm)	12	11-12	12	13	13-15	13
Lip region height (μm)	4	4	5	4	4-6	5-6
Amphid width (μm)	6	6-7	7	9	7-9	8-9
Sensillar pouches from amphid aperture (μm)	21	19-21	19	72	21-24	20-23
Odontostyle length (μm)	17	17-18	16	25	25-29	25-27
Odontophore length (μm)	28	25-28	24	34	34-40	34-36
Guiding ring from anterior end (μm)	11	10-11	10	17	16-18	17-18
Oesophagus total length (μm)	311	259-325	262	292	272-300	270-292
Oesophagus expanded part (μm)	122	105-122	93	108	97-108	96-106
Nerve ring from anterior end (μm)	128	112-130	123	136	134-148	138-144
Length of vagina (μm)	22	18-21	—	24	22-27	—
Prerectum length (μm)	112	70-129	135	121	67-94	127-141
Prerectum/anal body-width	4.0	2.8-4.8	4.8	3.6	2.1-3.0	3.7-4.3
Rectum length (μm)	30	25-28	—	34	31-34	—
Tail length (μm)	57	50-60	52	45	49-61	49-59
Tail/anal body-width	2.0	2.0-2.4	1.9	1.5	1.6-1.9	1.6-1.8
Spicules length (μm)	—	—	42	—	—	45-48
Lateral guiding pieces (μm)	—	—	7	—	—	9-11
No. of copulatory muscles	—	—	22	—	—	25-34
No. of ventromedian supplements	—	—	6	—	—	4-6

species of the genus Enchodelus

E. satendri n. sp.	*Enchodelus maximus* n. sp.		*Enchodelus parateres* n. sp.			*Enchodelus microdoroides* n. sp.		
Rohtang Pass Population (Type) ♀♀ (4)	Holotype ♀	Paratype ♀	Holotype ♀	Paratypes ♀♀ (10)	Paratypes ♂ (1)	Bharmar Population (Type) Holotype ♀	Bharmar Population (Type) Paratype ♀	Upper Bakrota Population ♀ (1)
1.43-1.54	2.60	2.48	1.44	1.20-1.57	1.49	1.24	1.16	1.09
23-27	41	45	28	26-30	29	25	28	24
4.3-4.6	6.0	5.8	5.7	5.1-6.0	6.0	4.3	4.4	3.9
27-34	43	41	48	47-59	55	59	58	58
53-56	49	51	53	50-54	54	47	47	49
19-24	15	16	21	14-19	—	20	18	17
19-22	14.5	16	18	16-23	—	21	18	22
3	3	3	2	1.5-2.0	1.5	2	2	2
5-6	8	8	6	6-8	7	6	6	6
14-15	15	16	15	13-15	15	13	14	13
6-7	7	7	5	5-6	6	5	6	5
9	10	11	7	7	7	8	8	7
20-22	25	26	21	21-22	22			19
29-30	54	57	22	21-22	22	40	42	40
38-40	53	56	26	23-28	25	47	43	45
18-19	35	36	13	13-15	13	37	37	39
323-332	431	423	251	236-273	251	285	268	276
116-120	161	156	92	85-101	83	99	96	92
143-150	185	182	111	106-122	123	158	130	142
24-28	24	25	18	16-22	—	22	21	22
63-95	192	160	112	80-112	94	82	92	78
2.0-3.0	5.6	5.0	3.5	2.5-3.2	2.9	2.7	3.3	2.9
34-38	35	40	25	25-30	—	27	24	27
45-53	60	62	30	23-28	27	21	21	19
1.6-1.8	1.8	1.9	0.9	0.6-0.8	0.8	0.7	0.8	0.7
—	—	—	—	—	50	—	—	—
—	—	—	—	—	8	—	—	—
—	—	—	—	—	30	—	—	—
—	—	—	—	—	7	—	—	—

Differential diagnosis: *Enchodelus maximus* n. sp. comes closest to *E. nepalensis* Zullini, 1973, but differs in having a longer and slenderer body (L = 2.1-2.3 mm and a = 23-30 in females of *E. nepalensis*), shorter odontostyle (odontostyle 66-70 μm in *E. nepalensis*), and in having differently shaped amphids.

ENCHODELUS PARATERES N. SP.
(Fig. 4)

Measurements: See Table I.

Description:

Female: Body tapering slightly towards both extremities, when fixed curving ventrally behind base of oesophagus and more so in posterior third. Cuticle finely striated, its thickness 6-8 μm on tail tip. Lateral chords 1/7th-1/5th of body-width near midbody. Dorsal, ventral and lateral body pores indistinct.

Lip region well set off from body, 1/4-1/3 body-widths at base of oesophagus. Amphids cup-shaped, curved slit-like apertures occupying about 1/2 of corresponding body-width. Odontostyle 1.4-1.7 head-widths long with an aperture about 1/8th of odontostyle length. Guiding ring 0.9-1.1 head-widths from anterior end. Odontophore 1.1-1.3 times the odontostyle length.

Basal expanded portion of oesophagus 34-37 % of neck length. The location of the oesophageal gland nuclei and their orifices is given in Table II. Nerve ring surrounding anterior slender part of oesophagus at 44-48 % of neck length from anterior end. Cardia hemispheroid, surrounded by intestinal tissues. A well developed oesophago-intestinal disc present. Prerectum 2.5-3.5 and rectum 0.8-1.0 anal body-widths long.

Vulva a transverse slit. Vagina extending 1/3-2/5 across the body, encircled proximally by cuticularization and distally by sphincter muscles. Gonads amphidelphic. Uterus divided into a proximal glandular and a distal muscular part. Ovaries reflexed; oocytes arranged in single row except in growth region.

Tail 0.7-0.9 anal body-widths long, bluntly-conoid or hemispheroid, with 2 caudal pores on each side.

Male: Supplements consist of an adanal pair and 7 ventromedians, the latter spaced at irregular intervals (Fig. 4, I). Spicules about 1.5 anal body-widths along median axis. Lateral guiding pieces well developed. Copulatory muscle bands occupying the area up to ventromedian supplements. Four pairs of rectal glands present. Subventral papillae 7, spaced at irregular intervals. Prerectum starts from 3rd ventromedian supplements, about 3 anal body-widths long.

Type habitat and locality: Soil around roots of weeds and mosses, Rohalla Falls (altitude approx. 8,500 ft.), Manali, district Kulu, H.P.

Type specimens: Holotype mounted on slide H.A.14/*Enchodelus parateres*/1, paratypes on slides H.A.14/*Enchodelus parateres*/2-4.

Differential diagnosis: *Enchodelus parateres* n. sp. comes close to *E. teres* Thorne,

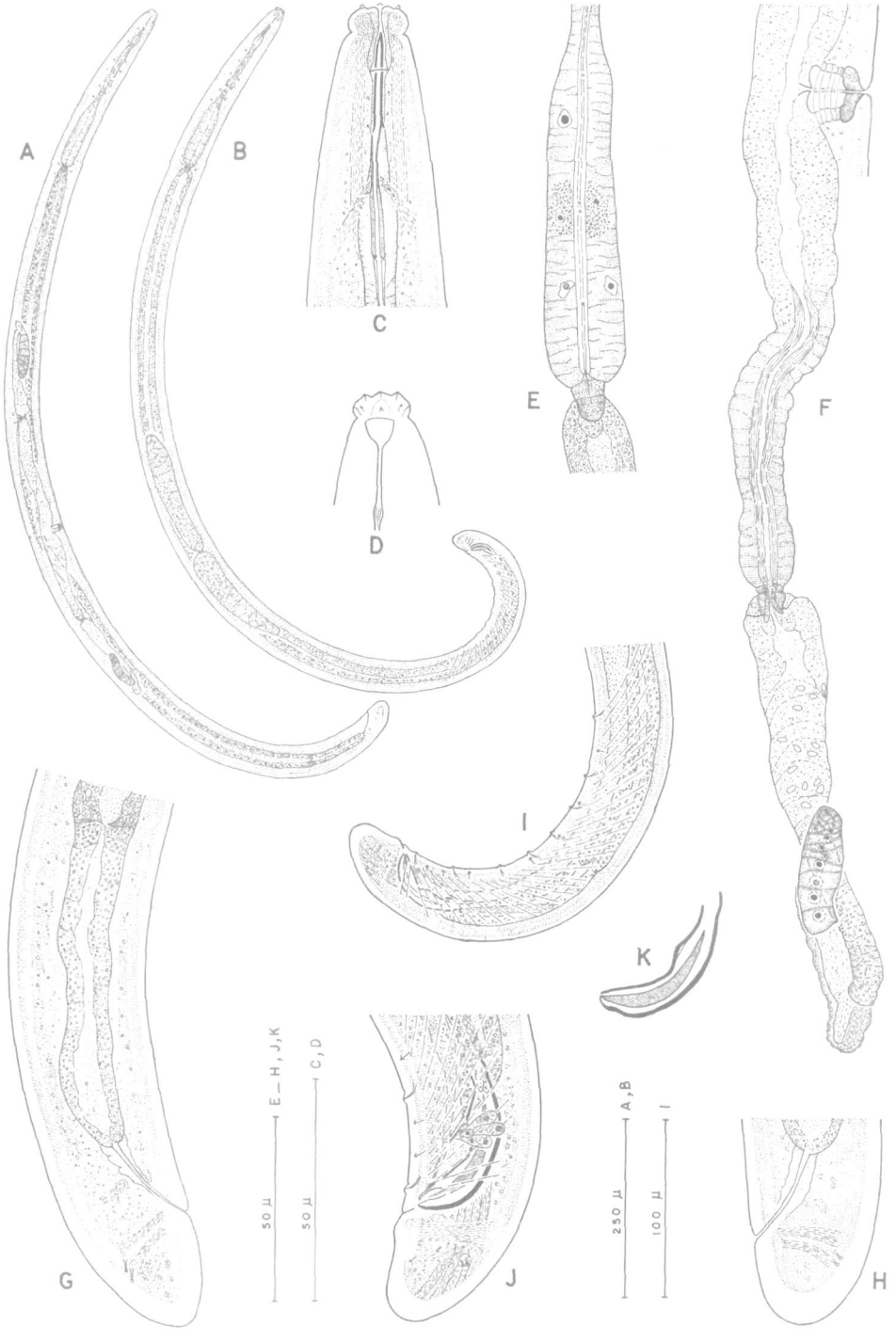

Fig. 4. *Enchodelus parateres* n. sp. A. Female entire, B. Male entire, C. Head end, D. Head end showing amphid, E. Expanded region of oesophagus, F. Posterior female sexual branch, G & H. Female tail ends, I & J. Male tail ends, K. Spicule.

1939 and *E. laevis* Thorne, 1939. It differs from the former in having a well set off and differently shaped lip region, differently shaped amphids, longer prerectum (prerectum twice the anal body-width in *E. teres*), tail differently shaped and without saccate bodies, sperm present in the oviduct and in being bisexual and from *E. laevis* in having differently shaped and well set off lip region, differently shaped amphids, longer odontostyle (odontostyle about one head-width in *E. laevis*), comparatively shorter odontophore in relation to odontostyle (odontophore about twice the odontostyle length in *E. laevis*), shorter basal expanded portion of oesophagus (basal expanded portion of oesophagus slightly less than 50 % of oesophageal length in *E. laevis*), and tail without saccate bodies.

ENCHODELUS MICRODOROIDES N. SP.
(Fig. 5)

Measurements: See Table I.

Description:

Female: Body tapering gradually in neck region, posterior half or third curved ventrally on fixation. Cuticle finely striated, its thickness on tail tip 6 μm. Lateral chords occupying 1/8th-1/7th of body-width near middle. Dorsal, ventral, and lateral body pores indistinct.

Lip region set off from body, about 1/3 body-width at base of oesophagus. Amphids cup-shaped, curved slit-like apertures occupying more than one-half to less than two-thirds of corresponding body-width. Odontostyle about 3 head-widths long; its aperture about 1/16th of odontostyle length. Guiding ring 2.6-3.0 head-widths from anterior end. Odontophore 1.0-1.2 times odontostyle length.

Basal expanded part of oesophagus 34-38 % of neck length. The location of oesophageal gland nuclei and their orifices given in Table II. Nerve ring surrounding anterior slender part of oesophagus at 48-54 % of neck length from anterior end. Cardia hemispheroid, surrounded by intestinal tissues. Prerectum 2.7-3.3, and rectum 0.8-1.1 anal body-widths long.

Vulva a transverse slit. Vagina extending about halfway across the body, encircled at proximal end by cuticularization and at distal end by sphincter. Gonads amphidelphic. Uterus divided into a proximal glandular and a distal muscular part. A round spermatheca-like structure is also present. Oviduct and uterus distinctly separated by a well developed sphincter. A prominent sphincter is also present between the ovary and oviduct pouch. Ovaries reflexed; oocytes arranged in single row except in growth region. Eggs 70 × 30 μm.

Tail 0.7-0.8 anal body-widths long, convex-conoid, with two caudal pores on each side.

Male: Not found.

Type habitat and locality: Soil around roots of barley, *Hordeum vulgare* near Railway Station, Bharmar (altitude approx. 1,800 ft.), H.P.

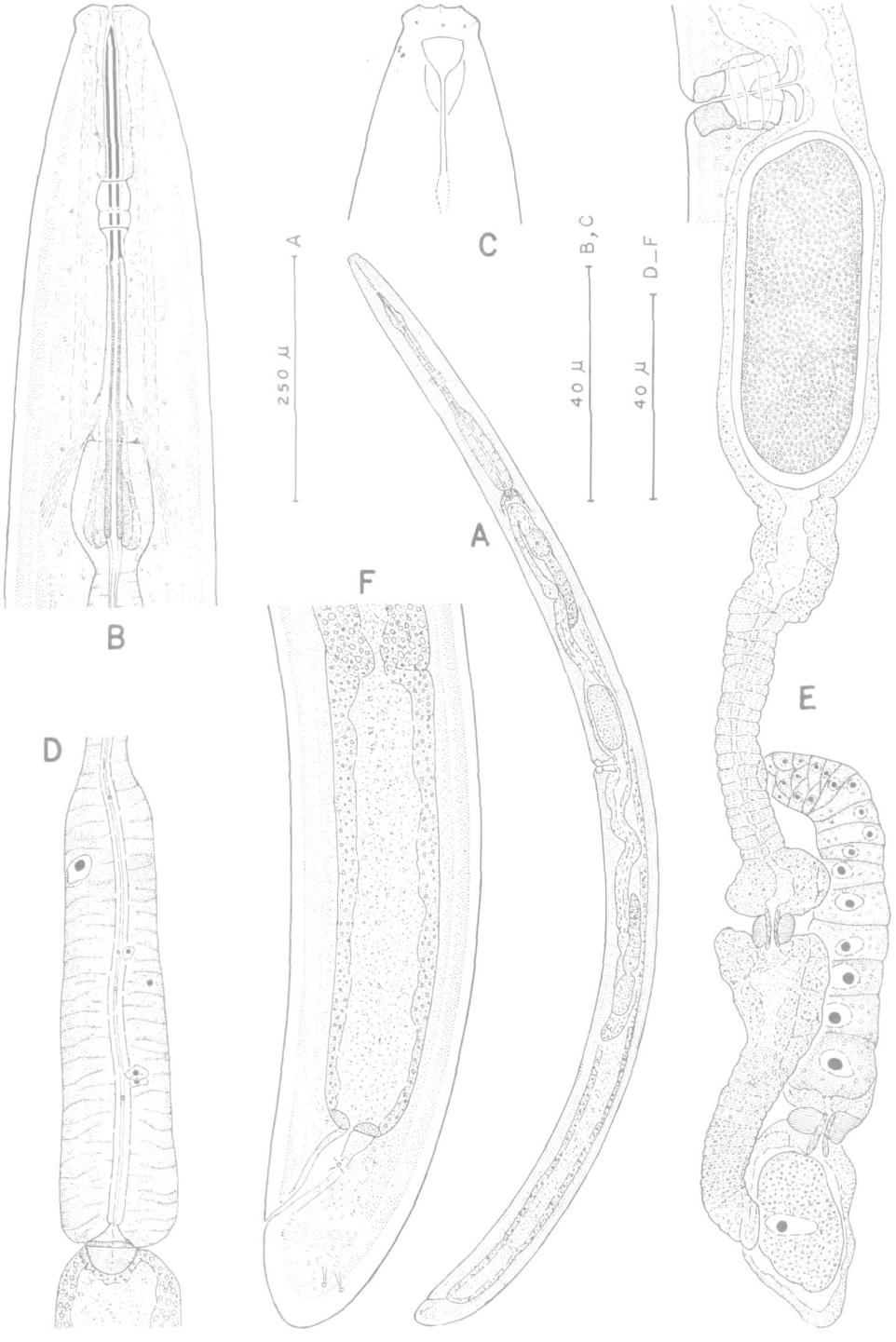

Fig. 5. *Enchodelus microdoroides* n. sp. A. Female entire, B. Head end, C. Head end showing amphid, D. Expanded region of oesophagus, E. Posterior female sexual branch, F. Female tail end.

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TABLE II

Location of oesophageal gland nuclei and their orifices in Enchodelus *species*

	E. thornei	*E. satendri*	*E. maximus*	*E. parateres*	*E. microdoroides*
DO	62.5-65.5	65.0-70.9	65.7	60.0-67.9	65.1-69.5
DN	66.6-69.7	69.2-75.3	68.9	63.6-72.9	71.5-75.0
DO-DN	3.3- 5.0	4.2- 5.4	3.2	3.6- 5.4	4.3- 6.5
S_1N_1	74-79	77-82	81	74-82	81-83
S_1N_2	76-82	78-84	83	76-84	82-84
S_2N	83-88	82-90	—	84-92	87-89
S_2O	84-89	83-90	—	85-93	88-90
K	*80-89*	*80-93*	*85*	*90-88*	*80-82*
K^1	85-93	86-96	88	86-94	87-88

Single specimen from soil around roots of unidentified grasses, Upper Bakrota Hills, Dalhousie (altitude approx. 7,000 ft.), H.P.

Type specimens: Holotype female along with paratype female mounted on slide H.A.6/*Enchodelus microdoroides*/1.

Specimen from Upper Bakrota Hills mounted on slide H.A.107/*Enchodelus microdoroides*/2.

Differential diagnosis: *Enchodelus microdoroides* n. sp. comes close to *E. macrodorus* (de Man, 1880) Thorne, 1939; *E. hopedorus* (Thorne, 1929) Thorne, 1939; and *E. hopedoroides* Altherr, 1963. The new species differs from *E. macrodorus*, in having a shorter body (L = 1.47-1.60 mm in *E. macrodorus*), posteriorly situated vulva (V = 42 in *E. macrodorus*), differently shaped amphids and tail, longer odontostyle (about 2.0-2.5 head widths in *E. macrodorus*), longer odontophore (less than 3 head-widths in *E. macrodorus*), and posteriorly situated guiding ring (about 1.5 head-widths from anterior end in *E. macrodorus*); it can be distinguished from *E. hopedorus* in having a shorter body (L = 1.43 mm in *E. hopedorus*), longer odontostyle (about 2 head-widths in *E. hopedorus*), longer odontophore (about 2.5 head-widths in *E. hopedorus*), posteriorly situated guiding ring (about 1.2 head-widths from anterior end in *E. hopedorus*), and differently shaped tail; it differs from *E. hopedoroides* by the smaller body (L = 1.42-1.85 mm in *E. hopedoroides*), longer odontostyle (about 2 head-widths in *E. hopedoroides*), longer odontophore (about 2.5 head-widths in *E. hopedoroides*), and differently shaped tail.

ENCHODELUS LONGIDENS JAIRAJPURI & LOOF, 1968

A single female of *Enchodelus longidens* has been recorded from soil around roots of deodar, *Cedrus deodara*, Nagar, district Kulu, H.P.

We thank the Head, Department of Zoology, Aligarh Muslim University, Aligarh for providing the laboratory facilities. The first author is grateful to the Council of Scientific and Industrial Research, New Delhi for financial assistance, and the second author to the University authorities for financial assistance under the 'Individual Research Scheme' of the Faculty of Science.

KEY TO SPECIES OF *ENCHODELUS*

1. Tail conoid, ventrally arcuate or straight 2
   Tail rounded or hemispheroid 14
2. Tail bluntly conoid, straight 3
   Tail sharply conoid, ventrally arcuate 4
3. Odontostyle 34 μm, 2 head-widths long ..... *zonatus* Jairajpuri & Loof, 1968
   Odontostyle 18 μm*, 1.5-1.6 head-widths long ... *conicaudatus* (Ditlevsen, 1927) Thorne, 1939
4. Odontostyle over 1.4 head-widths long 5
   Odontostyle about one head-width long ..... *brevidentatus* Thorne, 1939
5. Body cuticle marked by coarse transverse striations ..... *striatus* Thorne, 1939
   Body cuticle without coarse transverse striations 6
6. Tail somewhat digitate; body length 2.8 mm ..... *faeroensis* (Ditlevsen, 1928) Thorne, 1939
   Tail not digitate; body length under 2.6 mm 7
7. Odontostyle over 40 μm or more than 3 head-widths long 8
   Odontostyle 40 μm or less, less than 2.5 head-widths long 10
8. Odontostyle length 40-46 μm; odontophore as long as odontostyle .....
   ..... *longidens* Jairajpuri & Loof, 1968
   Odontostyle length over 50 μm; odontophore less than the odontostyle length 9
9. Odontostyle 53-56 μm or 3.5-3.6 head-widths long ..... *maximus* n. sp.
   Odontostyle 66-70 μm or 4.3 head-widths long ..... *nepalensis* Zullini, 1973
10. Odontostyle about 2 head-widths long 11
    Odontostyle about 1.5 or less head-widths long 12
11. Odontostyle length 23-24 μm; odontophore without basal flanges .....
    ..... *constrictus* Jairajpuri & Loof, 1968
    Odontostyle length 25-30 μm; odontophore with prominent basal flanges ..... *satendri* n. sp.
12. Odontophore with basal flanges ..... *thornei* n. sp.
    Odontophore linear without basal flanges 13
13. Body length 1.8-2.6 mm; female gonads with a peculiar ovoid chamber .....
    ..... *magnificus* (Altherr, 1952) Altherr, 1963
    Body length 1.5 mm; peculiar ovoid chamber absent ..... *arcuatus* Thorne, 1939
14. Body length 0.59-0.79 mm ..... *parvus* Loof, 1971
    Body length 1 mm or more 15
15. Body length 2.5 mm ..... *groenlandicus* (Ditlevsen, 1927) Thorne, 1939
    Body length under 2.0 mm 16
16. Odontostyle one head-width long ..... *laevis* Thorne, 1939
    Odontostyle over one head-width long 17
17. Odontostyle 2 or more head-widths long 18
    Odontostyle less than 2 head-widths long 22
18. Tail with 10-15 pairs of 'saccate bodies**' ..... *hopedorus* (Thorne, 1929) Thorne, 1939
    Tail without 'saccate bodies' 19

* After Jairajpuri & Loof (1968).

** After Loof (1971).

19. Odontostyle length 40 μm or more 20
Odontostyle length less than 40 μm 21
20. Body length 1.5-1.6 mm; odontostyle 2.0-2.5 head-widths long ..... *macrodorus* (de Man, 1880) Thorne, 1939
Body length 1.09-1.24 mm; odontostyle 3 head-widths long ..... *microdoroides* n. sp.
21. Odontostyle 25-27 μm long ..... *altherri* Vinciguerra & de Francisci, 1973
Odontostyle 30-35 μm long ..... *analatus* (Ditlevsen, 1927) Thorne ,1939
22. Tail with 'saccate bodies' 23
Tail without 'saccate bodies' 24
23. Tail with 50 'saccate bodies' ..... *teres* Thorne, 1939
Tail with about a dozen 'saccate bodies' ..... *vestibulifer* Altherr, 1952
24. Lip region amalgamated, only slightly set off from the body contour ..... *vesuvianus* (Cobb, 1893) Thorne, 1939
Lip region not amalgamated, well set off from the body contour 26
25. Lip region angular; vulva pre-equatorial (V = 46-48) ..... *hopedoroides* Altherr, 1963
Lip region hemispheroidal; vulva post-equatorial (V = 50-54) ..... *parateres* n. sp.

For synonymies and departures under this genus see Zullini (1973).

ZUSAMMENFASSUNG

Nematoden aus Hochgebirgslagen in Indien. V. Fünf neue Arten der Gattung Enchodelus *Thorne, 1939 (Dorylaimida)*

Es werden fünf neue *Enchodelus*-Arten beschrieben: *Enchodelus thornei* n. sp. 1,28-1,67 mm lang; Odontostyl 16-18 μm; Odontophor 24-28 μm; Schwanz in beiden Geschlechtern gebogen-konisch. *Enchodelus satendri* n. sp. 1,38-1,88 mm lang; Odontostyl 25-30 μm; Odontophor 34-40 μm; Schwanz in beiden Geschlechtern kurz konisch, im letzten Drittel ventral gebogen. *Enchodelus maximus* n. sp. 2,48-2,60 mm lang; Odontostyl 54-57 μm; Odontophor 53-56 μm; Schwanz konisch und ventral gebogen. *Enchodelus parateres* n. sp. 1.20-1,57 mm lang; Odontostyl 21-22 μm; Odontophor 23-28 μm; Schwanz in beiden Geschlechtern kurz, stumpf-konisch oder halbrund. *Enchodelus microdoroides* n. sp. 1.09-1,24 mm lang; Odontostyl 40-42 μm; Odontophor 43-47 μm; Schwanz kurz, konvex-konisch. *Enchodelus longidens* Jairajpuri & Loof, 1968 wurde auch gefunden. Es wird ein Bestimmungsschlüssel für die Arten der Gattung *Enchodelus* mitgeteilt.

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A Taxonomic Revision of the Nematode Species described by S. Stekhoven & Teunissen (1938) and S. Stekhoven (1944) from National Virunga Park, Zaïre Republic

II. *Actinolaimidae*

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ABSTRACT

The representatives of the family Actinolaimidae described by S. Stekhoven & Teunissen (1938) and S. Stekhoven (1944) are redescribed. The specimens available for study have been identified as belonging to 3 genera and to 3 species. One new species, *Paractinolaimus zairensis* is described and its variability, especially with regard to the cheilostomal armature is discussed. Comments are given on the relation between *Paractinolaimus*, *Neoactinolaimus* and *Afractinolaimus*. The genus *Mactinolaimus* is considered as a synonym of *Neoactinolaimus* and four new combinations are proposed.

The group of actinolaims is considered here as a family under Dorylaimoidea and the present taxonomy of the group is criticized.

INTRODUCTION

This is the second paper dealing with a revision of the taxonomic work published by S. Stekhoven & Teunissen (1938) and S. Stekhoven (1944). For material and methods and abbreviations in the tables the reader should refer to the first paper (Baqri & Coomans, 1973).

The group of actinolaims is here considered a family under Dorylaimoidea. In the recent literature however this group is usually treated as a superfamily with several families. The specimens described by S. Stekhoven & Teunissen (1938) and S. Stekhoven (1944) belong to the genera *Neoactinolaimus* Thorne, 1967, *Metactinolaimus* Meyl, 1957 and *Paractinolaimus* Thorne,1967.

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We agree with Heyns & Argo (1969) that Thorne (1967) made a lapsus when he included *Metactinolaimus* Meyl, 1957 in the diagnosis and key of his family Paractinolaimidae. Andrássy (1970) apparently holds the same opinion since he writes (l.c. p. 200) that the family Neoactinolaimidae was erected by Thorne (1967) for three genera, *Neoactinolaimus, Metactinolaimus* and *Egtitus* Thorne, 1967 and (p. 205) that the family Paractinolaimidae was erected for two genera, *Paractinolaimus* Meyl, 1957 and *Westindicus* Thorne, 1967.

Heyns & Argo (1969) synonymized *Egtitus* with *Neoactinolaimus*. We agree with these authors that the so called postextension constriction is not a useful character at the generic level. Their argumentation about the use of the arrangement of the male supplements is less convincing, though it can be accepted on practical grounds.

Andrássy (1970) on the other hand proposed a new genus, *Mactinolaimus* for those species without secondary teeth in the buccal cavity. Since these structures are differentiations of the sides of the four large onchia (= cheilostomal teeth) and since the latter show a lot of interspecific variation in size and shape we are rather reluctant from differentiating genera on that character alone. Furthermore species with secondary vestibular teeth also occur in *Actinolaimus* (e.g. *A. straeleni* Meyl, 1957).

At present, it therefore seems preferable to reject the genus *Mactinolaimus*, till further information will allow a better evaluation of the different morphological characters.

When *Mactinolaimus* is considered a junior synonym of *Neoactinolaimus* four new combinations have to be proposed : *Neoactinolaimus birketi* (Altherr, 1960) n. comb., *Neoactinolaimus omercooperi* (Filipjev, 1931) n. comb., *Neoactinolaimus pooensis* (Gadea, 1950) n. comb. and *Neoactinolaimus typicus* (Andrássy, 1970) n. comb.

The remaining genus under « Neoactinolaimidae », *Metactinolaimus* was erected by Meyl (1957) for two species, *M. kreisi* Meyl, 1957 and *M. leloupi* Meyl, 1957. The main diagnostic character for that genus is « a cuticularized pharyngeal framework consisting of the amalgamated four onchia, in place of more or less foreward pointing, sharp teeth (onchia)» (Meyl, 1957, p. 47). However this character has not been studied in much detail so far and although this genus may be valid it needs a better definition. It is unfortunate that *M. kreisi* was selected as type species instead of the better described *M. leloupi*.

The « family Paractinolaimidae » now contains the genera *Paractinolaimus*, *Westindicus* and *Afractinolaimus* Andrássy, 1970. The representatives of these genera are characterized by the presence of numerous small denticles in the buccal cavity. As pointed out by Heyns & Argo (1969) this character constitutes the only real distinction between « Paractinolaimidae » and « Neoactinolaimidae ».

Again it should be stressed that such a character is insufficient to separate groups at the family level. Although it is beyond the scope of this paper to discuss the taxonomy of the whole group in detail, an outline is necessary. As explained above the group is considered here as a family (Actinolaimidae). The species with longitudinal striae or ridges on the cuticle then constitute a taxon at the subfamily level (Actinolaiminae)[1]). The genera grouped under Neoactinolaimidae and Paractinolaimidae in recent classifications constitute an other subfamily (Neoactinolaiminae). Trachypleurosidae should be brought to subfamily level (Trachypleurosinae). Carcharolaimidae and Mylodiscidae are not regarded as closely related to the Actinolaimidae (cf. also Loof & Coomans, 1970 for a discussion on the position of *Carcharolaimus*).

Groupings of genera within the three subfamilies can be easily established by the use of the tribe category.

The specimens studied are deposited at the Museum voor Midden-Afrika, Tervuren, Belgium, together with these of the previous paper (Baqri & Coomans, 1973).

DESCRIPTIONS

In the following table the species described by S. Stekhoven & Teunissen (1938) and S. Stekhoven (1944) are listed on the left side under the name mentioned in those publications. On the right side the present status of the species is given.

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[1]) In this respect it should be noted that Heyns & Argo (1969) describe a new species of *Actinolaimus*, *A. perplexus*, with characters of both « Actinolaiminae » and « Brittonematinae » (sensu Thorne, 1967).

Status of *Actinolaimidae*
described by S. Stekhoven & Teunissen, 1938 (**)
and S. Stekhoven, 1944 (*).

Past	Present
* *Actinolaimus africanus* Filipjev, 1929	*Neoactinolaimus africanus* (Filipjev, 1929) Thorne, 1967
** *Actinolaimus ruwenzorii* De Coninck, 1935	1. *Metactinolaimus* spec. 2. *Mesodorylaimus ruwenzorii* (De Coninck, 1935) Andrássy, 1959
* & ** *Actinolaimus omercooperi* Filipjev, 1931	*Paractinolaimus zairensis* sp. n.

Subfamily **Neoactinolaiminae** (Thorne, 1967) n. rank.

NEOACTINOLAIMUS Thorne, 1967

Neoactinolaimus africanus (Filipjev, 1929) Thorne, 1967 (Fig. 1)

Measurements: ♀: L = 6.07 mm; a = 61; b = 6.0; c = 22; V = 24; G_1 = 6; G_2 = 43; A = 3.4; B = 1.9; odontostyle = 40 μm; odontophore = 42 μm.

Description.

Female. Body slightly curved ventrally, tapering slightly towards both ends. Cuticle finely striated transversally, about 9 μm thick at mid-body becoming thinner on tail. Lateral chords about one quarter of the body-width near middle. Lateral body pores 218; 39 of these in the œsophageal region, starting as a single row, then in two rows (along dorsal and ventral side of lateral chord), 149 between cardia and prerectum, 26 in the region of the prerectum and rectum, 4 caudal. Posteriorly a number of pores are in lateroventral and laterodorsal position. Ventral body pores 47; dorsal body pores 26.

Lip region slightly demarcated by a depression; with amalgamated lips. Amphids 12 μm wide, stirrup-shaped, occupying more than 1/3rd of the corresponding body-width. Cheilostomal wall moderately sclerotized, armed with four onchia. Faint secondary teeth appear to be present. Denticles absent. Odontostyle 1.6 lip region widths long,

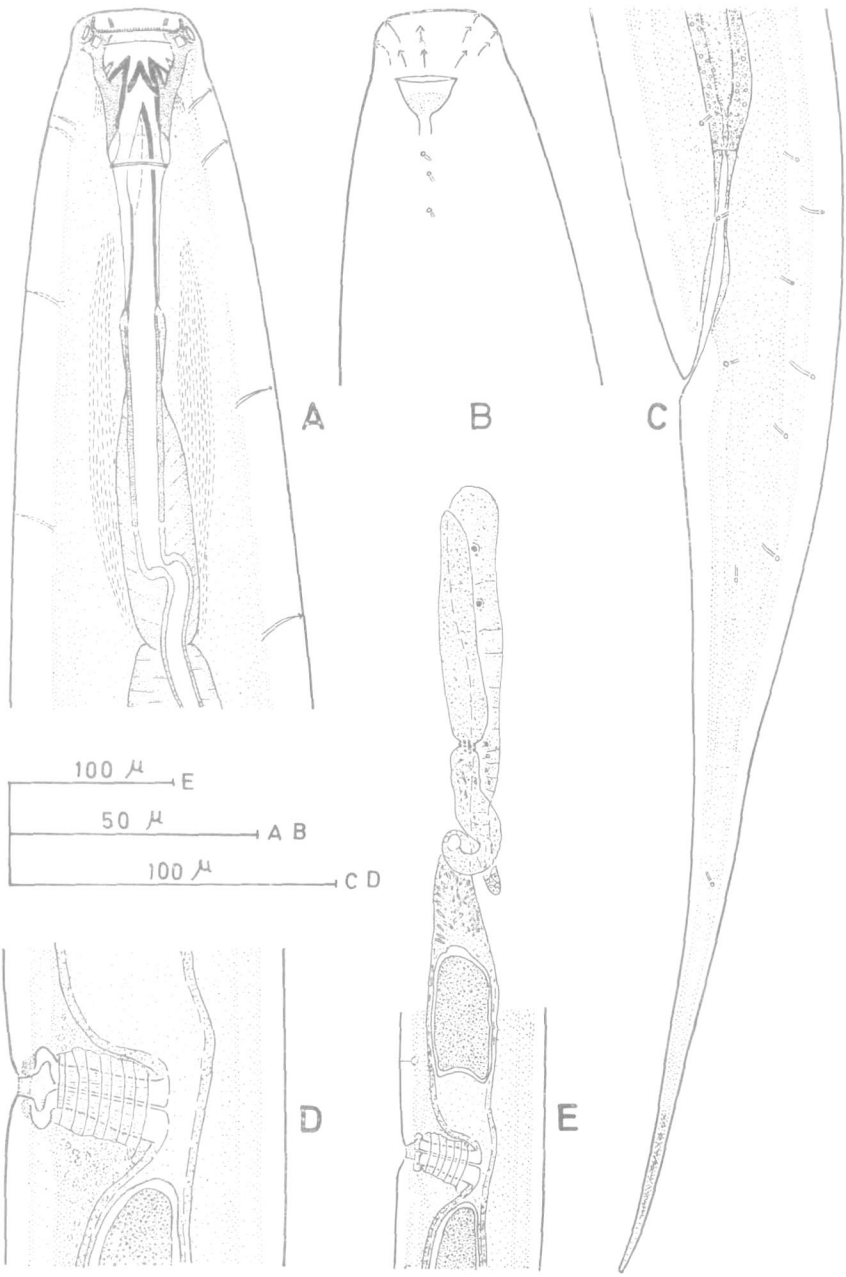

Fig. 1. — *Neoactinolaimus africanus* (Filipjev, 1929) Thorne, 1967.
A: Anterior region; - B: Surface view of anterior region; - C: Tail region;
- D: Vulval region; - E: Anterior branch of female reproductive system.

aperture about half the odontostyle length. Guiding ring about 1.2 lip region widths or 30 μm from anterior body end. Due to distortion, the protractor muscles of the spear are disconnected in the odontostyle region and retractors are not visible.

Anterior slender part of œsophagus and ellipsoidal swelling of odontophore region offset by a constriction at their junction. Posterior to this constriction the œsophageal region is distorted and a number of details are obscured, e.g. nerve ring, œsophageal gland nuclei and outlets, cardia. Prerectum 373 μm or about 8 anal body-widths long; cells with microvilli. Rectum 70 μm, about 1.5 anal body-widths long.

Vulva a transverse oval, approximatively 32 × 16 μm. Vagina 45 μm long or slightly more than half of the corresponding body-width; with moderately sclerotized distal part. Female reproductive system amphidelphic; anterior branch very small in comparison with the posterior one, but consisting of all typical parts; uterus containing a single egg (Fig. 1 E). Posterior branch distorted; with thirty eggs in the uterus, irregular in shape and arrangement, 82-101 ($\bar{X}$ = 92) × 33.5-45 ($\bar{X}$ = 38) μm.

Tail elongate, tapering gradually to a narrow tip; 271 μm or 6 anal body-widths long; with 4 caudal pores on each side.

Locality and habitat: Freshwater, National Virunga Park, Zaïre, locality and habitat not further defined.

Remark: Filipjev (1929) describes the vulva as slit-like.

METACTINOLAIMUS Meyl, 1957

The diagnosis given by Meyl (1957) is rather poor and that given by Thorne (1967) is mainly based on *M. kreisi* Meyl, 1957, therefore an amended diagnosis is given:

Actinolaimidae, Neoactinolaiminae. Buccal cavity with fused onchia forming a more or less strongly developed secondary spear-guide. Odontostyle length 0.6 to 1.5 times the lip region width, its aperture occupying 40 to 65 % of its length. Ovaries two. Female tail elongated, male tail bluntly rounded. Supplements in 2 or 3 fascicles.

Metactinolaimus spec. (Fig. 2)

syn. *Actinolaimus ruwenzorii* apud S. Stekhoven & Teunissen, 1938 (partim)

nec *Paractinolaimus ruwenzorii* (De Coninck, 1935) Andrássy, 1964

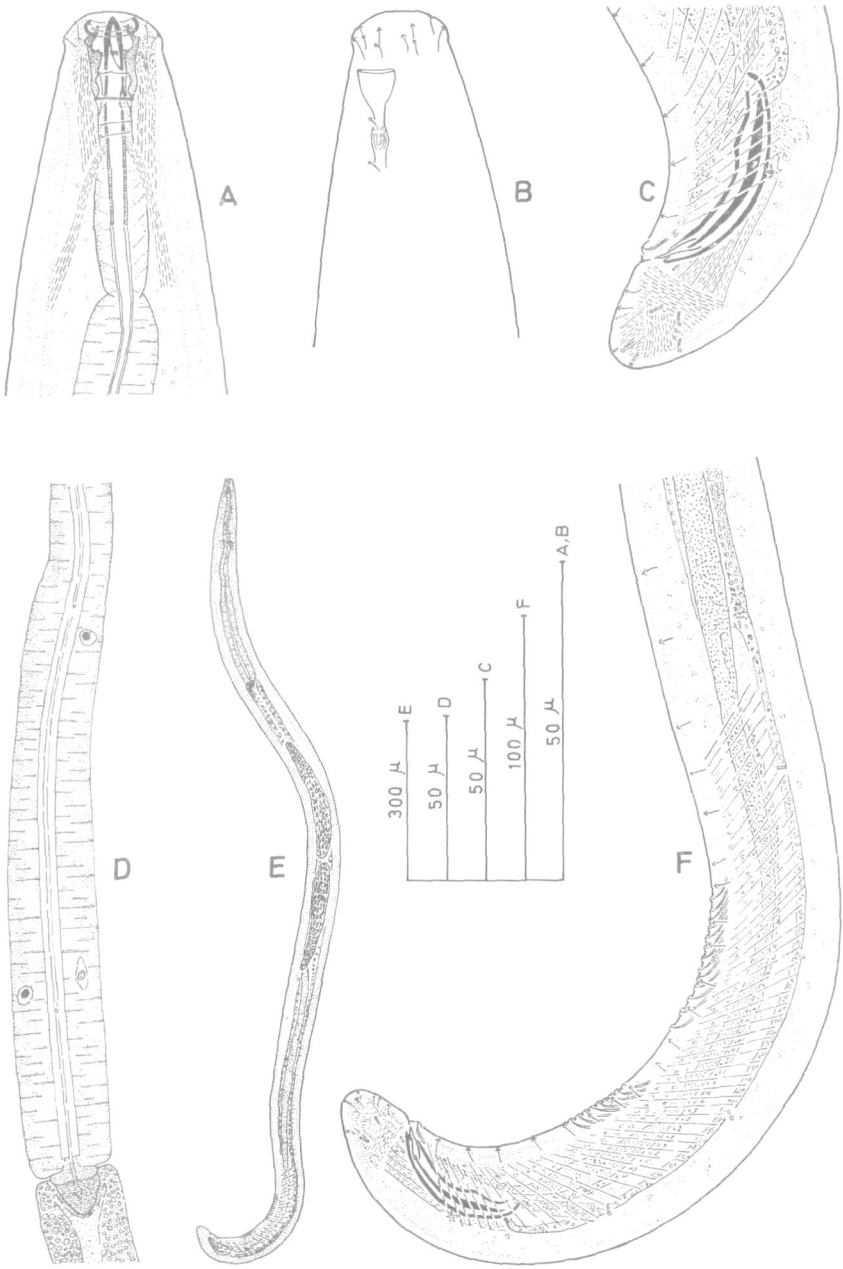

Fig. 2. — *Metactinolaimus* spec.
A: Anterior region; - B: Surface view of anterior region; - C: Tail region;
- D: Basal expanded portion of œsophagus; - E: Entire male; - F: Posterior region

S. Stekhoven & Teunissen (1938) reported *Actinolaimus ruwenzorii* De Coninck, 1935 [1]) from Visoke volcano, from Rutshuru, from « sample G » and from Sesero. Although the authors did not mention the Sesero-population under the description of the species, 8 ♀♀, 6 ♂♂ and 7 juveniles are reported under sample no. 515 from that locality. The specimens from Rutshuru and sample G are apparently lost, those from Visoke volcano (sample 1122) belong to *Mesodorylaimus ruwenzorii* (De Coninck, 1935) Andrássy, 1959 ! S. Stekhoven and Teunissen (1938) thus identified a male from that sample as *Dorylaimus ruwenzorii* (cf. Baqri & Coomans, 1973), but misidentified the other specimens (1 ♂, 5 ♀♀ and 2 juv.) as *Actinolaimus ruwenzorii* (erroneously reported as *A. omercooperi* p. 132 in their publication). From Sesero, only one male and one juvenile are preserved. The male does agree neither with the description of De Coninck (1935) nor with that of S. Stekhoven & Teunissen (1938). Arrangement of ventromedian supplements and shape of spicules of the Sesero-male are different from those depicted by S. Stekhoven and Teunissen (1938, Fig. 74 B). This male lacks denticles in the buccal cavity and is described here as *Metactinolaimus* spec. because it fits best the diagnosis of that genus. It is different from the two *Metactinolaimus* species so far described, but since we have only one specimen, we prefer not to name it.

Measurements: L = 1.64 mm; a = 26; b = 4.2; c = 75; T = 66; A = 3.8; B = 1.7; odontostyle = 13 μm; odontophore = 20 μm; spicules = 56 μm; lateral guiding pieces = 12 μm.

Description.

Male. Body irregularly curved (Fig. 2 E), tapering anteriorly. Cuticle 3 μm thick, without visible striation. Lateral chords 1/5th of the body-width near mid-body. Lateral body pores very faint and obscure except in œsophageal region (24 pores) and in the region of the prerectum (21 pores, 13 of which are latero-ventral and 8 latero-dorsal). Six dorsal pores occur in the anterior body region, up to the level of the nerve ring.

Lip region offset by slight constriction; with amalgamated lips. Amphids 8 μm wide, occupying slightly less than 1/3rd of the corresponding body-width; sensillae 15 μm behind the aperture. Vesti-

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[1]) This species was transferred to *Paractinolaimus* by Andrássy (1964) and to *Metactinolaimus* by Andrássy (1970). In view of the presence of denticles in the buccal cavity (cf. De Coninck, 1935) the species belongs to *Paractinolaimus*.

bule armed with four flattened onchia, appearing to form a ring-like structure around the odontostyle. Secondary cheilostomal teeth and denticles absent. Odontostyle length 0.9 times the lip region width; aperture about 2/3rd of the odontostyle length. Odontophore about 1.5 times as long as the odontostyle. Guiding ring « double », fixed ring situated at 14 μm or about one lip region width from anterior body end.

Anterior slender part of œsophagus and ellipsoidal swelling of odontophore region offset by a constriction at their junction. Basal expanded portion of œsophagus occupying 46 % of neck region. First pair of lateroventral œsophageal gland nuclei and orifices not visible. Locations of other nuclei and orifices :

DO = 55.5	DO - DN = 2.8	S_2N = 86
DN = 58.3		S_2O = 87

Cardia small, anterior portion disc-like, posterior portion conoid. Prerectum 277 μm or about 9 anal body-widths long. Nerve ring 112 μm from anterior end.

Male genital system typical. Spermatozoa elliptical, 9 - 12 μm long. Spicules about 1.9 anal body-widths long. Lateral guiding pieces more or less rod-shaped. Supplements consisting of an adanal pair and 22 ventromedians, the latter arranged in two groups, an anterior one of 13 and a posterior one of 9. Subventral papillae 23, reaching till anterior to the intestine-prerectum junction. Copulatory muscles in 57 bands.

Tail bluntly conoid; 23 μm long, i.e. 3/4th of anal body-width; with 9 caudal pores on each side.

Juvenile. Belonging to the fourth stage; agreeing with the male in general body features except for long filiform tail. L = 1.51 mm; a = 40; b = 4.4; c = 9; odontostyle = 12 μm; replacement odontostyle = 15 μm.

Locality and habitat : Sesero Mountain, north of the Miceno volcano, Bambo forest and mixed woodland. Alt. 2,000 m.

Differential diagnosis: Metactinolaimus spec., comes close to *M. leloupi* Meyl, 1957, but differs from it in having 22 ventromedian supplements (15 in *M. leloupi*); longer and better developed lateral guiding pieces (obscure and very short in *M. leloupi*) and higher number of caudal pores (5 in *M. leloupi*).

PARACTINOLAIMUS Meyl, 1957

« *Actinolaimus omercooperi* » was reported in both publications from various localities of National Albert Park. The specimens studied by S. Stekhoven & Teunissen (1938) are apparently lost so that their identity cannot be checked. In 1957, Meyl described a new *Actinolaimus* species, *A. schuurmansstekhoveni* on the basis of a single female from a small pond at Edith-Bay and synonymized *A. omercooperi* apud S. Stekhoven & Teunissen, 1938 with it. Comparison of descriptions and drawings of the 1938 and 1944 papers show a number of differences so that different species might have been involved.

For the present study most of the specimens used for the 1944 paper were available. None of these specimens belong to *A. schuurmansstekhoveni.*

Paractinolaimus zairensis sp. n. (Fig. 3 - 6)

syn. : *Actinolaimus omercooperi* apud S. Stekhoven, 1944

Type population (Kimboho) (Fig. 3 B-Q)

Measurements : see Table 1.

Description

Female. Body nearly straight or « C »-shaped upon fixation, tapering slightly towards both ends. Cuticle finely striated transversally. Lateral chords about 1/5 - 1/4 of body-width near middle. Lateral body pores visible, but faint in one female; first in a single row, then arranged in two rows (along dorsal and ventral side of lateral chords).

Lip region 18 - 21 μm wide, demarcated by a slight depression. Lips amalgamated, with the usual number of papillae in two circlets, but with forward position of the submedian ones. Amphids goblet-shaped; apertures occupying slightly less than one third of the corresponding body-width. Two rather opaque, elongate bodies of unequal size along both sides of the amphidial canals (Fig. 3 N). Cheilostome armed with four onchia. A single or a double, somewhat irregular circle(s) of denticles is present at the level of the tips of the onchia; the denticles are also in lateral view clearly visible (Fig. 3 D, L, M). Odontostyle about 1.2 - 1.3 lip region widths long; its aperture about half the odontostyle length. Odontophore 1.2 - 1.4 times the odontostyle length. Guiding ring « double », fixed ring about one lip region width from anterior extremity.

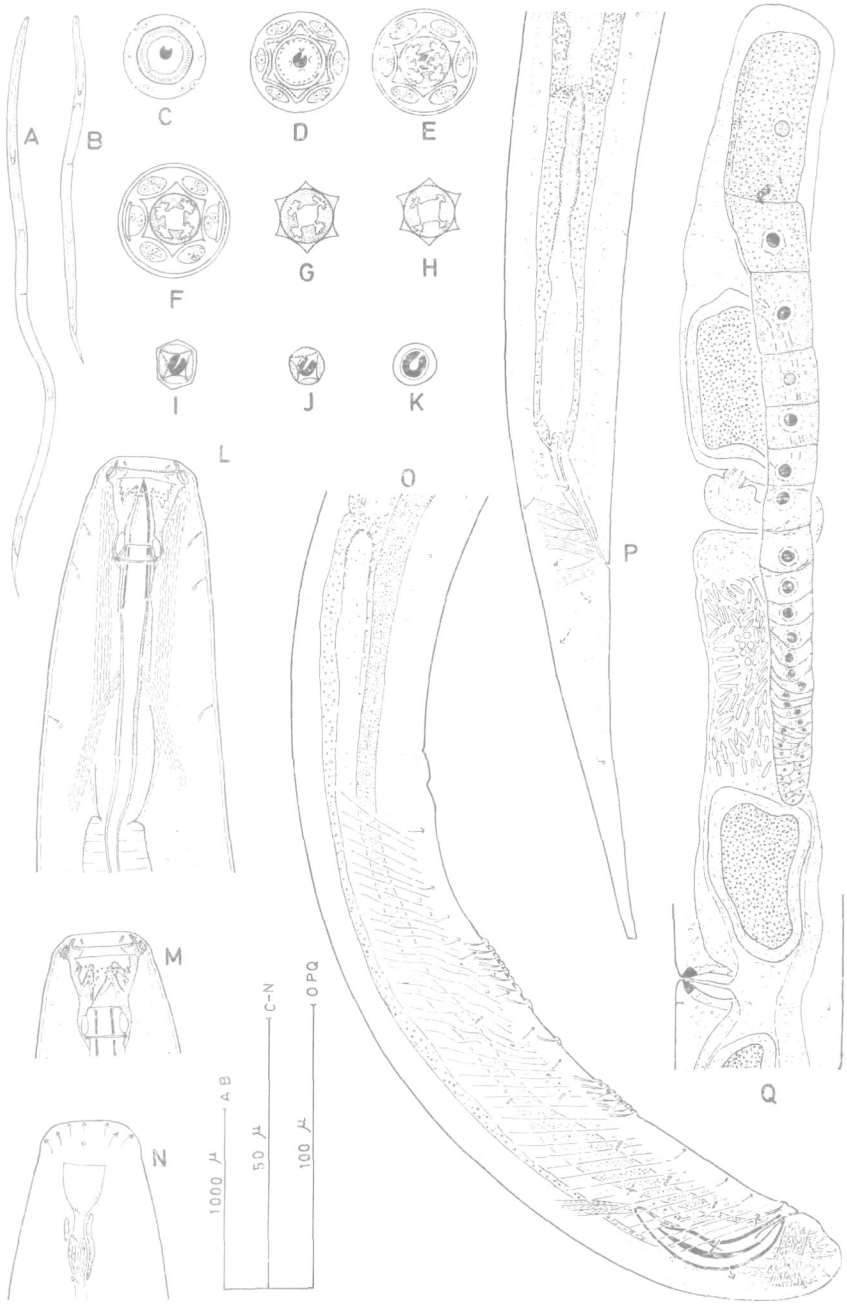

Fig. 3. — *Paractinolaimus zairensis* sp. n.

All drawings, except A are from the type population (Kimboho).

A: Habitus female of Gando population; - B: Habitus female of type population; - C-K: Cross sections through the anterior end of a male; - D: Cross section at the level of the circlets of denticles; - L: Anterior region; - M: Anterior end; - N: Surface view of anterior end; - O: Posterior region of male; - P: Posterior region of female; - Q: Anterior branch of female reproductive system.

Anterior slender part of œsophagus and ellipsoidal swelling of odontophore region distinctly offset by a constriction at their junction. Basal expanded portion of œsophagus occupying 51 - 53 % of neck region. Locations of œsophageal gland nuclei and orifices :

DO = 49.4 - 51.0	S_1O_1 and S_1N_1 = 66 - 67		
DN = 50.6 - 52.4	S_1O_2 and S_1N_2 = 71 - 72		
DO-DN = 1.2 - 1.4	S_2N = 83 - 84	K = 73 - 75	
	S_2O = 84 - 85	K' = 75 - 77	

Cardia tongue-shaped, about 1/3rd of the corresponding body-width long; consisting of two parts, the posterior one surrounded by intestinal tissue, the anterior part forming a well developed œsophago-intestinal disc. Prerectum 4 - 5 anal body widths long. Microvilli are well developed in the prerectum. Rectum 1.5 anal body widths long.

Vulva a transverse oval. Vagina 20 - 21 μm long or about 1/3rd of the corresponding body-width, with sclerotized distal part. Genital tract amphidelphic; posterior branch longer than anterior one. Uterus with a wide proximal and a narrow convoluted distal part. Sphincter between uterus and oviduct well developed. Oocytes arranged in a single row except in the region of multiplication. Uteri filled with sperms. Anterior uterus containing one egg (70×34 μm in holotype, 63×38 μm in paratype), posterior uterus containing two to four distorted eggs.

Tail elongate, tapering gradually; in the holotype, the tail tip is broken off, so that exact value of « c » must be slightly smaller than mentioned in Table 1. Three caudal pores present on each side.

Male. Similar to female in general body shape and morphology except in tail shape. Male genital system typical. Spermatozoa spindle-shaped or elliptical. Spicules with simple median piece, 1.9 - 2.1 anal body-widths long. Lateral guiding pieces well developed. In addition to the adanal pair, 14 - 16 ventromedian supplements are present, the latter arranged in two groups (fascicles) of 6 - 8 (anterior group) and 6 - 7 supplements with in between 1 - 2 single ones. Subventral papillae spaced irregularly, reaching beyond the region of supplements. Prerectum 8 - 9 anal body-widths long. Tail convex-conoid with bluntly rounded terminus, slightly less than 2/3rd of anal body-width long; with 7 - 8 caudal pores on each side.

Type specimens : Holotype (♀) slide no. M.T. 36.127.

Paratypes : 1 ♀ and 2 ♂♂ on slides nos. M.T. 36.128; M.T. 36.129; M.T. 36.130A respectively (specimen in slide no. M.T. 36.130A decapilated, head mounted « en face » in slide no M.T. 36.130B).

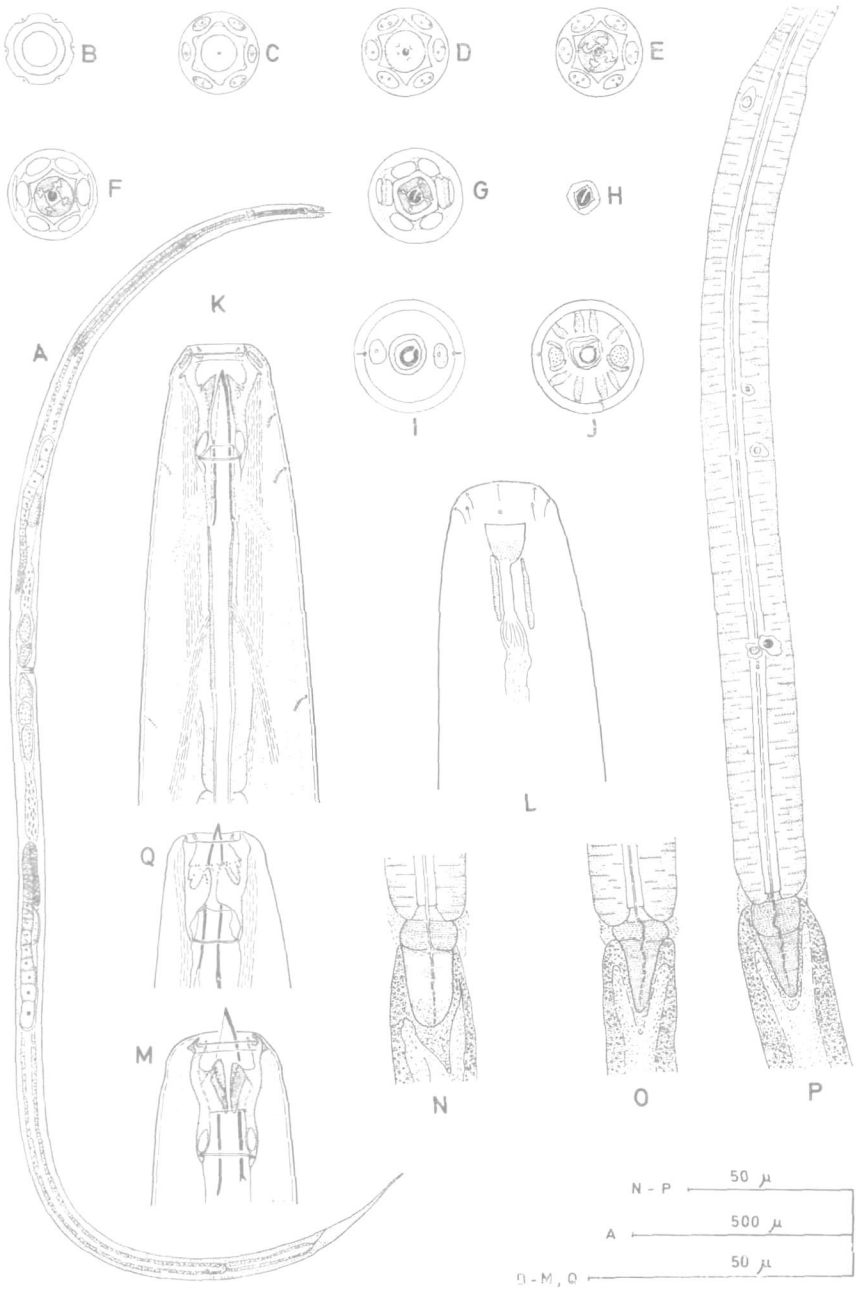

Fig. 4. — *Paractinolaimus zairensis* sp. n.

Gando population : B-J: Cross sections through the anterior end; - D: Cross section at the level of the circlet of denticles; - L: Surface view of anterior region; - M: Anterior end; - N: Œsophago-intestinal junction.

Lake Ndalaga, Mokoto population : A: Entire female; - K: Anterior region; - Q: Anterior end.

Kamande population : O: Œsophago-intestinal junction; - P: Basal expanded portion of œsophagus.

Type locality and habitat: collected from the margin of the lake Kimboho on 29.XI.1935 by H. Damas (sample no. 455).

Gando population (Figs. 4 B-J, L-N; 5A, D, E, G, I)

Agreeing with the type population in general morphology except for morphometric characters (see Table 1) and the following features: cheilostome with four onchia, each flanked in its basal portion by two oblique longitudinal rows of denticles, giving the onchia a serrated appearance. At the level of the tips of the onchia occurs a single circlet of very minute denticles which are only faintly visible in « en face » view (Fig. 4 D).

Prerectum 5 - 8 anal body-widths in females and 10 - 14 in males.

In some females the ovaries are very long and reflexed two or even three times. Only one female with eggs, one in each uterus.

Habitat and location

Material collected by H. Damas on 12.III.1935 in small pools at Ilega (Gando): 5 ♀ ♀ and 2 ♂ ♂ (sample no. 55).

Other populations (Figs. 4 A, K, O, Q; 5 B, C, F, H)

Agreeing with the type population in general morphology except for morphometric characters (see Table 2) and the following features: cheilostome with four onchia flanked by irregular, oblique longitudinal rows of denticles which are smaller than those in the specimens from Gando. Only one circlet of regularly distributed denticles at the level of the tips of the onchia (Fig. 4 K, Q). In some females the ovaries are reflexed twice (Fig. 4 A). The highest number of eggs observed per uterus is 5. One female contained as much as 9 eggs (4 in the anterior, 5 in the posterior uterus). In some males three nucleated ejaculatory glands are well visible, at both sides of the body, in the region of the prerectum (Fig. 5 C).

Habitat and location

Material collected by H. Damas: 4 ♀ ♀ and 1 juv. among algae of Lake Ndalaga, Mokoto, on 15.VIII.1935 (sample no. 339); 2 ♀ ♀ and 4 ♂ ♂ collected among algae at Keshero, on 17.IV.1935 (sample no. 106); 3 ♀ ♀, 6 ♂ ♂ and 1 juv. collected at Kamande on 8.V.1935 (sample no. 141); 1 ♂ collected on 7.VIII.1935 (sample no. 301) and 1 ♀ and 2 juv. collected on 23.VIII.1935 (sample no. 365) from the margin of Lake Kalondo; 1 ♂ collected from Kishushu Island, Lake Kivu on 5.X.1935 (sample no. 428); 1 ♂ collected at Nianga on 19.X. 1935 (sample no. 430).

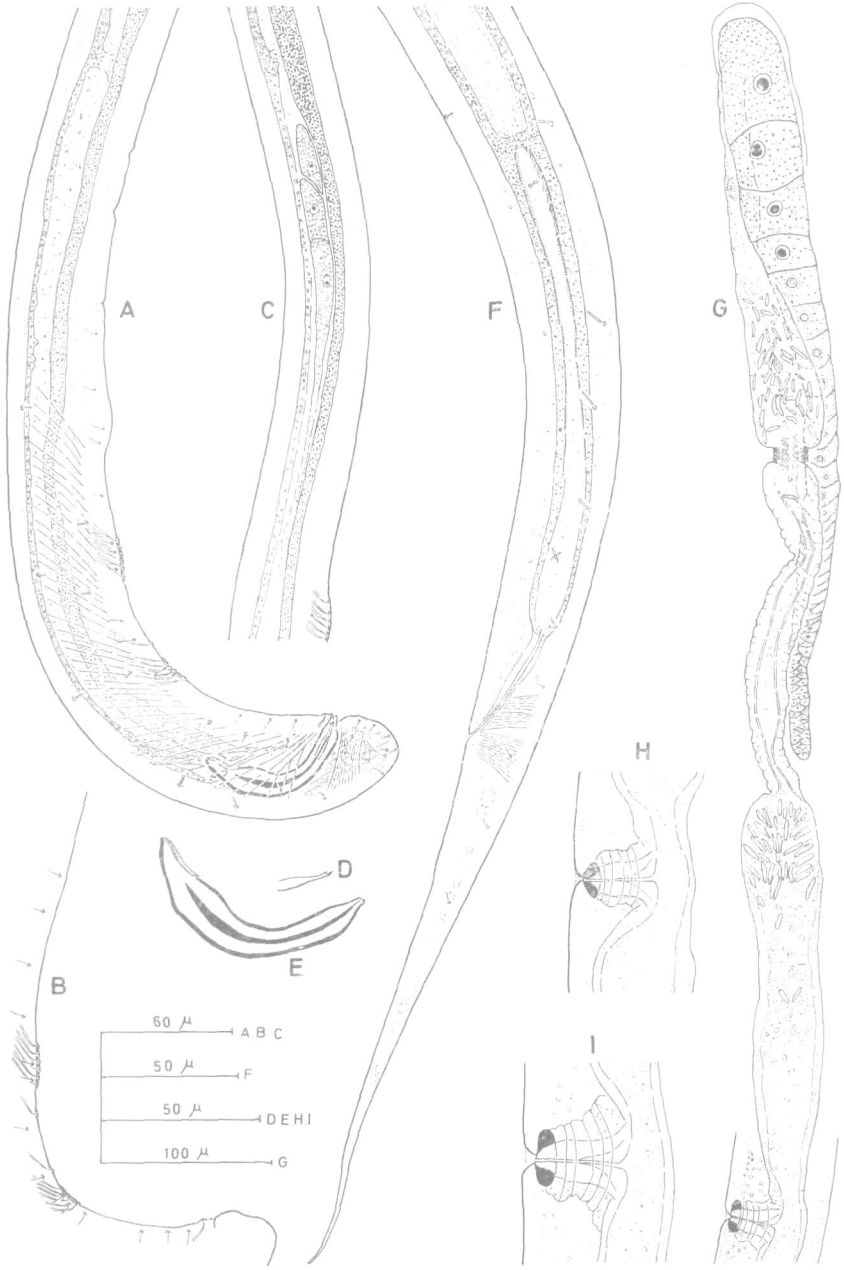

Fig. 5. — *Paractinolaimus zairensis* sp. n.
Gando population : A: Posterior region of male; - D: Lateral guiding piece; - E: Spicule; - G: Anterior branch of female reproductive system; - I: Vulval region. Populations, other than type- and Gando population : B: Posterior region of male showing supplements and subventral papillae; - C: Ejaculatory glands of male; - F: Posterior region of female; - H: Vulval region.

Differential diagnosis

The smaller specimens of *Paractinolaimus zairensis* sp. n. resemble *P. capensis* Heyns & Argo, 1969. The latter has also supplements arranged in fascicles and a cheilostomal armature that comes close to the one of *P. zairensis*. The anterior thickening of the spear remains distinctive for *P. capensis*.

The comparison of morphometric characteristics is not relevant here since *P. zairensis* has shown to be a very variable species.

The larger specimens of *P. zairensis* are clearly distinguished from all the other species of *Paractinolaimus* by their cheilostomal structure.

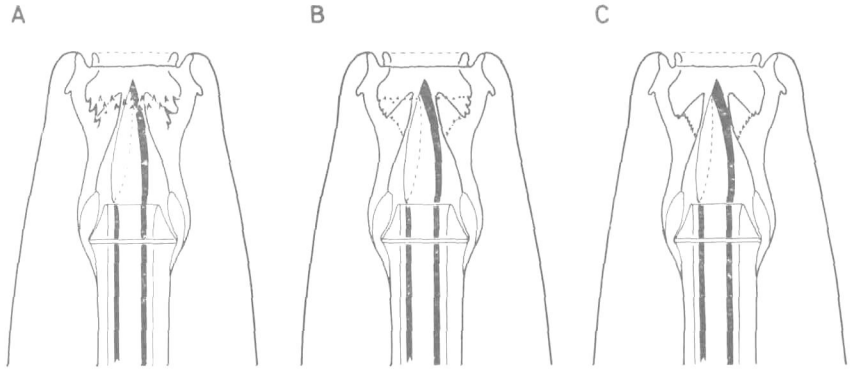

Fig. 6. — Scheme of the anterior end of *Paractinolaimus zairensis* sp. n. showing the cheilostomal armature in the different populations studied.

A: Type population (Kimboho); - B: Intermediate populations; - C: Gando population.

Discussion

Comparison of the Kimboho (= type) population and the Gando population shows rather clearcut differences between both, e.g. with respect to a number of morphometric characters, especially body length (L = 1.59 - 1.87 mm for Kimboho specimens and L = 3.62 - 5.09 mm for those from Gando) and odontostyle length (22-23 μm against 30 - 33 μm) and with respect to the development of denticles in the buccal cavity (see above).

If, however, the other populations are taken into account these extremes are linked by a series of transitions, e.g. in body length (L = 1.94 - 3.65 mm), odontostyle length (25 - 28 μm) and development of denticles in the buccal cavity (Fig. 6).

Considering the fact that all the specimens studied are very similar in overall appearance and that the differences between the extremes are covered by intermediate forms, they are all considered to belong to one and the same species. The cheilostomal denticles show a different development : those forming a circlet are most prominent in the smallest specimens and those forming oblique longitudinal rows alongside the onchia are best developed in the largest specimens. Hence the differences are more of quantitative than of qualitative order. Different environmental conditions could account for these differences, but detailed information on the sampling site is unfortunately not available.

GENERAL DISCUSSION

The denticular arrangement and development in the cheilostome of *P. zairensis* n. sp. is strongly suggestive for an intermediate position between the genera *Neoactinolaimus* and *Paractinolaimus* on the one hand and between the genera *Afractinolaimus* and *Paractinolaimus* on the other. Indeed, whereas the other species of *Paractinolaimus* usually possess a large number of denticles, the smallest specimens of *P. zairensis* n. sp. have only one or at most two circlets. Furthermore the variation in the denticular pattern recorded for the latter species, makes it difficult to accept this character as a diagnostic criterion for separating taxa above the genus level. The genus *Afractinolaimus* has been based on a single species, *A. noblei* Andrássy, 1970, which possesses longitudinal rows of cheilostomal denticles comparable — though more numerous — to those found in the larger forms of *P. zairensis* sp. n. Gonads which are two or three times reflexed are considered to be a diagnostic feature for *Afractinolaimus*, but occasionally occur in *P. zairensis* sp. n. In this case even the validity of the genus *Afractinolaimus* may be questioned.

All this further supports the view expressed in the introduction to this paper, i.e. that there is no sound basis for the inflation of taxonomic levels in this group.

RESUME

Les espèces appartenant à la famille des Actinolaimidae, publiées par S. Stekhoven & Teunissen (1938) et S. Stekhoven (1944) sont décrites à nouveau. Les spécimens étudiés représentent trois genres et appartiennent à trois espèces. Une nouvelle espèce, *Paractinolaimus zairensis* est décrite en détail dont les données morphométriques très divergentes et la variabilité de l'armature cheilostomale ont été analysés. La relation entre *Paractinolaimus, Neoactinolaimus* et *Afractinolaimus* est discutée. *Mactinolaimus* est synonymisé avec *Neoactinolaimus* et quatre combinations nouvelles sont proposées.

A notre avis les nématodes actinolaimides forment une famille dans la superfamille Dorylaimoidea et la taxonomie actuelle des actinolaimides est critiquée.

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TABLE 1

Measurements and diagnostic features
of *Paractinolaimus zairensis* sp. n.

Locality	Kimboho			Gando	
Specimens (No)	Holotype (♀)	Paratype (♀)	Paratypes (2 ♂♂)	4 (♀♀)	2 (♂♂)
L (mm)	1.87	1.83	1.59 - 1.69	3.62 - 5.09	3.65 - 4.40
a	32	31	26 - 27	68 - 86	70 - 73
b	4.4	4.2	3.9 - 4.1	4.7 - 6.0	4.1 - 4.7
c	« 14 »	14	76 - 100	14 - 23	152 - 191
V/T	42.5	42	67 - 70	43 - 50	53
G_1	18	17.5	—	14 - 16	—
G_2	31.5	33.5	—	14 - 17	—
cut. m. (μm)	2	2	2	2 - 3	3
cut. t. (μm)	3	3	3	2 - 3	4
Lat. b. p.	84	—	118 (n = 1)	—	—
œs.	29	—	30	—	—
ca. - prer.	44	—	55	—	—
prer. ~ r.	8	—	25	—	—
c. p.	3	3	8	3	7 - 9
vent. b. p.	45	35	—	?	?
dors. b. p.	4	4	3	4 - 5	4 - 5
A	3.0	3.0	3.0 - 3.1	2.8 - 3.0	2.3 - 2.9
B	2.7	—	2.5	2.3 - 2.5	2.3 - 2.6
amph. w. (μm)	9	8	8 - 9	8 - 9	8 - 9
sens. (μm)	15	16	15 - 16	18 - 20	18 - 19
od. st. (μm)	23	—	22 - 23	30 - 32	31 - 33
od. st. ap. (μm)	12	—	12 - 13	14 - 15	15 - 16
od. ph. (μm)	32	28	28 - 30	32 - 35	33 - 35
g. r. (μm)	20	20	19 - 20	22 - 23	23
prer. (μm)	128	116	253 - 300	153 - 218	363 - 510
r. (μm)	47	41	8 - 10	48 - 52	—
an. diam. (μm)	26	27	30 - 32	28 - 30	36
t. (μm)	« 131 »	132	17 - 21	226 - 300	23 - 24
nrv. r. (μm)	137	133	134 (n = 1)	175 - 204	205 - 209
egg (μm)	62 - 70 × 33 - 37	63 × 38 (n = 1)	—	77 - 82 × 39 - 40	—
spic. (μm)	—	—	63 - 65	—	75 - 76
l. g. p. (μm)	—	—	13 - 14	—	17 - 19
supp.	—	—	14 - 16	—	13 - 14
s. v. p.	—	—	14	—	16 - 18
cop. musc.	—	—	41 - 50	—	43 - 52
sperm. (μm)	7 - 9	7 - 9	7 - 9	8 - 11	8 - 11

TABLE 2

Measurements and diagnostic features
of *Paractinolaimus zairensis* sp. n.

Locality	Ndalaga Lake	Kamande		Keshero	
Specimens (No)	4 (♀ ♀)	3 (♀ ♀)	6 (♂ ♂)	2 (♀ ♀)	3 (♂ ♂)
L (mm)	2.92 - 3.53	2.46 - 3.39	2.74 - 3.30	2.00 - 2.08	1.94 - 2.11
a	60 - 69	56 - 61	48 - 63	34 - 34.5	30 - 39
b	4.7 - 5.7	4.7 - 6.1	5.0 - 7.2	4.1 - 4.3	4.1 - 4.5
c	15 - 19	15 - 18	137 - 183	10 - 11	103 - 125
V/T	40 - 45	43 - 44	66 - 73	41 - 43	69 - 72
G_1	13 - 17	19 - 21	—	16 - 18	—
G_2	15 - 25	26 - 31	—	24 - 26.5	—
cut. m. (μm)	2	2	2 - 3	2.5 - 3	4 - 4.5
cut. t. (μm)	2 - 3	2 - 3	2 - 3	2.5 - 3	4
Lat. b. p.	—	127 - 132	138 - 144	—	—
œs.	—	28 - 29	22 - 27	—	—
ca. - prer.	—	81 - 83	78 - 90	—	—
prer. & r.	—	17 - 18	23 - 24	—	—
c. p.	3 - 4	2 - 3	8 - 9	—	—
vent. b. p.	42 - 47	—	47 - 69	—	—
dors. b. p.	3 - 5	4 - 5	4 - 5	—	—
A	2.4 - 2.6	2.5 - 3.0	2.5 - 2.9	2.3	2.3 - 2.8
B	2.2 - 2.4	2.1 - 2.2	2.0 - 2.4	3 - 3.5	3.1 - 4.1
amph. w. (μm)	7 - 8	7 - 8	7 - 8	7	7.5 - 9
sens. (μm)	19 - 20	17 - 19	18 - 19	18	13.5 - 16.5
od. st. (μm)	25 - 28	26	25 - 28	26 - 27	27 - 28
od. st. ap. (μm)	12 - 13	12 - 14	12 - 14	12.5 - 13	11.5 - 16
od. ph. (μm)	30 - 32	28 - 30	28 - 30	—	—
g. r. (μm)	20 - 22	19	19 - 20	19 - 20.5	20.5 - 23
prer. (μm)	170 - 205	171 - 200	350 - 395	84 - 115	292.5 - 358
r. (μm)	42 - 48	34 - 42	11 - 13	47 - 49	—
an. diam. (μm)	23 - 28	22 - 26	27 - 30	24.5 - 27	28 - 33
t. (μm)	188 - 229	160 - 186	16 - 19	177 - 206	17 - 19.5
nrv. r. (μm)	166 - 178	141 - 158	148 - 163	145 - 146	141 - 155.5
egg (μm)	59 - 83 × 29 - 34	53 - 75 × 35 - 42	—	65 - 68 × 24 - 37	—
spic. (μm)	—	—	59 - 62	—	63.5 - 69
l. g. p. (μm)	—	—	15 - 16	—	13 - 16.5
supp.	—	—	13 - 15	—	14 - 16
s. v. p.	—	—	14 - 15	—	—
cop. musc.	—	—	43 - 49	—	—
sperm. (μm)	8 - 11	8 - 12	8 - 12	8 - 10	6.5 - 9

Dr. B. S. Chauhan Comm. Vol., pp. 171-180, (1975)

TWO NEW SPECIES OF THE GENUS *APORCELAIMELLUS* HEYNS, 1965 WITH SOME REMARKS ON THE RELATIONSHIP OF *APORCELAIMELLUS* WITH *EUDORYLAIMUS* ANDRASSY, 1959 (DORYLAIMOIDEA : NEMATODA)

QAISER H. BAQRI and S. KHERA

Zoological Survey of India, Calcutta

The species described here were collected from soil around roots of banana in Reang, Dist. Darjeeling, West Bengal (India). The analysis of these samples showed a wide variety of tylenchid, dorylaimid, mononchid and other soil inhabiting nematodes. In this paper only two new species of the genus *Aporcelaimellus* Heyns, 1965 are described. Some notes on the genus *Aporcelaimellus* are given and its relationship with genus *Eudorylaimus* Andrássy 1959 discussed. The species of the genus *Eudorylaimus* having relationship with some species of *Aprocelaimellus* are transferred to the latter.

The nematodes were fixed in hot 4% formalin, transferred in glycerine-alcohol, dehydrated slowly in a desiccator and mounted in anhydrous glycerine.

Type material has been labelled and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

APORCELAIMELLUS CHAUHANI* N. SP.

(Text-fig. 1)

MEASUREMENTS :

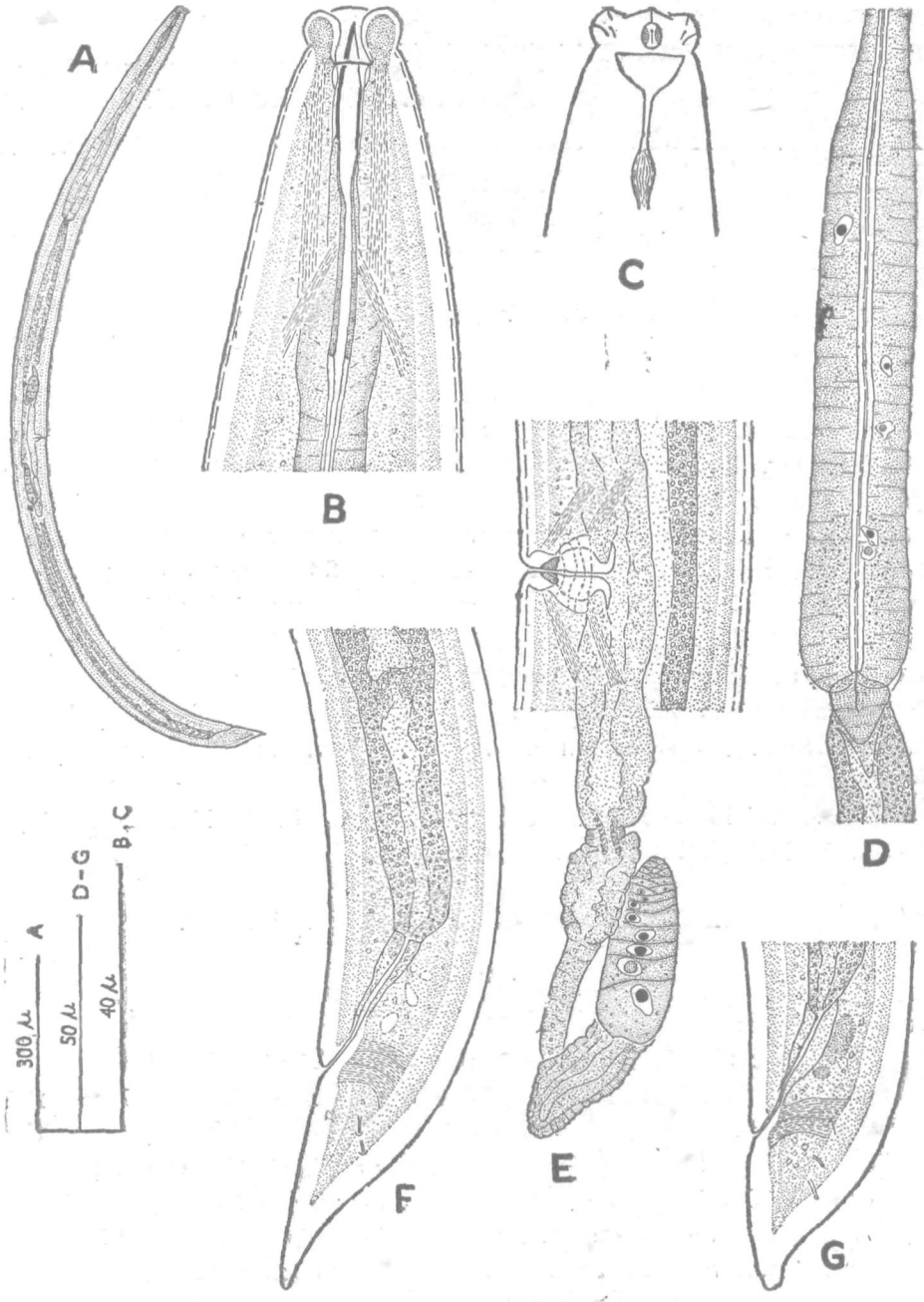
Holotype ♀ : L=1.41 mm ; a=24 ; b=3.8 ; c=32 ; $V=^{13}$ 51.^{12}

Paratypes (10 ♀ ♀) : L=0.96-1.42 mm ; a=21-26 ; b=3.0-3.7 ; c=24-34 ; $V=^{9-13}$ 50-54 $^{8-13}$.

DESCRIPTION—Female : Body ventrally curved, slightly tapering towards anterior end. Cuticle finely striated transversely ; its thickness 3μ in mid-body, 5-7μ at tail and 14-20μ on tail tip. Lateral chords 1/8th-1/6th of body width near the middle. Lateral, ventral and dorsal body pores not distinct.

Lip region well offset by a constriction, slightly wider than adjoining body, 1/3.4-1/2.6 of body width at the base of oesophagus. Amphids stirrup shaped ;

* Named in honour of Dr. B. S. Chauhan



Text-fig. 1—*Aporcelaimellus chauhani* n. sp.

A - Entire female ; B - Anterior region ; C - Surface view of anterior region ; D - Basal expanded portion of oesphagus, oesophageal gland nuclei and orifices ; E - Vulva region and posterior gonad ; F - Posterior end with normal tail ; G - Tail with broken tip.

apertures occupying 9-10μ or 63-71% of the corresponding body width, and 5-6μ from anterior end. Sensillar pouches 17-19μ from amphidial aperture.

Odontostyle 17-20μ or 1.0-1.4 lip region width long ; aperture 9-11μ or 51-55% of odontostyle length. Guiding ring 7-8μ or about $\frac{1}{2}$ of lip region width from anterior extremity, Odontophore 30-35μ or 1.5-1.8 times the odontostyle length. Basal expanded portion of oesophagus occupying 42-47% of the neck region. Locations of oesophageal gland nuclei and orifices as follows :

DO=59.1—63.2	S_1N_1=74—79	S_2N=88—93
DN=61.7—68.5	S_1N_2=78—84	S_2O=90—95
DO—DN=2.6—5.3	dist. =4.2—7	

K=66—76 K'=75—78

Nerve ring 120-134μ or 35-42% of neck region from anterior end. Cardia conoid with rounded terminus, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 46-77μ or 1.5-3 anal body width long. Rectum 27-38μ or 1.1-1.4 anal body width long.

Vulva a transverse slit. Vagina 21-25μ or 1/1.8-1/2.5 of the corresponding body width long, surrounded by a feeble sphincter ; with moderately sclerotized distal region which is quite far from vulvar opening. Gonads amphidelphic, typical and short. Sperm not seen. Egg size 94×39μ.

Tail dorsally convex-conoid with sub-acute terminus, blunt terminus in one tail which is with broken tip (Fig. 1, G) ; 34-45 μ or 1.4-1.8 anal body width long ; with two caudal pores on each side.

Male : Not found.

Type locality and habitat : From soil around roots of banana from Reang, Dist. Darjeeling (West Bengal), India.

Type specimens : Collected by Shri T. D. Soota in July, 1974 ; holotype (having an egg in anterior sexual branch) along with one paratype mounted on slide W. N. 81, *Aporcelaimellus chauhani* n. sp. ; other paratypes on slides W. N. 82-83 *Aporcelaimellus chauhani* n. sp.

DIFFERENTIAL DIAGNOSIS : *Aporcelaimellus chauhani* n. sp. comes close to *A. paraconicaudatus* (Meyl, 1956) Heyns, 1965, *A. propinquus* (Thorne & Swanger, 1936) Tjepkema, Ferris and Ferris, 1971, and *A. laevis* Tjepkema, Ferris and Ferris, 1971. From *A. paraconicaudatus* it differs in having differently shaped lip region and amphids, smaller odnostotyle aperture (aperture 60% in *A. paraconicaudatus*), smaller prerectum (prerectum 4-5 times the rectum length in *A. paraconicaudatns*), and differently shaped tail (tail conical with more rounded terminus in *A. paraconicaudatus*). From *A. propinquus* it differs in having differently shaped lip region and amphids, and dorsally convex-conoid tail (tail blunt, uniformly conoid in *A. propinquus*). From *A. laevis* the new species differs in having less offset lip region (lip region offset by a very deep constriction in

A. laevis), differently shaped amphids, and longer and differently shaped tail (c=53-63, tail dorsally convex with blunt or very blunt end in *A. laevis*).

APORCELAIMELLUS COOMANSI* N. SP.

(Text-fig. 2)

MEASUREMENTS :

Holotype ♀ : L=1.74 mm ; a=30 ; b=3.5 ; c=35 ; $V=^{10}55^{13}$.

Paratypes (3 ♀♀) : L=1.68-1.90 mm ; a=32-33 ; b=3.8-4.1 ; c=34-35 ; $V=^{911}-53-58^{9-10}$.

DESCRIPTION—Female : Body ventrally curved in posterior half, slightly tapering towards anterior end. Cuticle marked with distinct striations ; its thickness 3μ in mid-body, 7μ at tail and 13-17μ on tail tip. Dorsal and ventral body pores 5-6 and 11-12 respectively. Lateral chords about 1/5th of body near middle. Lateral body pores irregularly arranged along dorsal and ventral sides of lateral chords, 55-58 in number of which 13-17 in oesophageal region, 30-36 from cardia up to intestine — prerectum junction, 7-8 in prerectum and rectum and 2-3 in caudal region.

Lip region well offset by a constriction, wider than adjoining body. Amphids stirrup-shaped, pouch divided into two parts by a faint transverse line ; apertures occupying 9 u or about 65% of the corresponding body width, and 5 μ from anterior end. Sensillar pouches 18-19 μ from amphidial aperture.

Odontostyle 17-18 μ or 1.1 lip region width long ; apertuse 11-12 μ or 65-67% of odontostyle length. Guiding ring irregular in outliue, 7-8 μ or about $\frac{1}{2}$ the lip region width from anterior extremity. Odontophore 28-29 μ or 1.6-1.7 times the odontostyle length. Basal expanded portion of oesophagus occupying 53-55% of the neck region. Locations of oesophageal gland nuclei and orifices as follows :

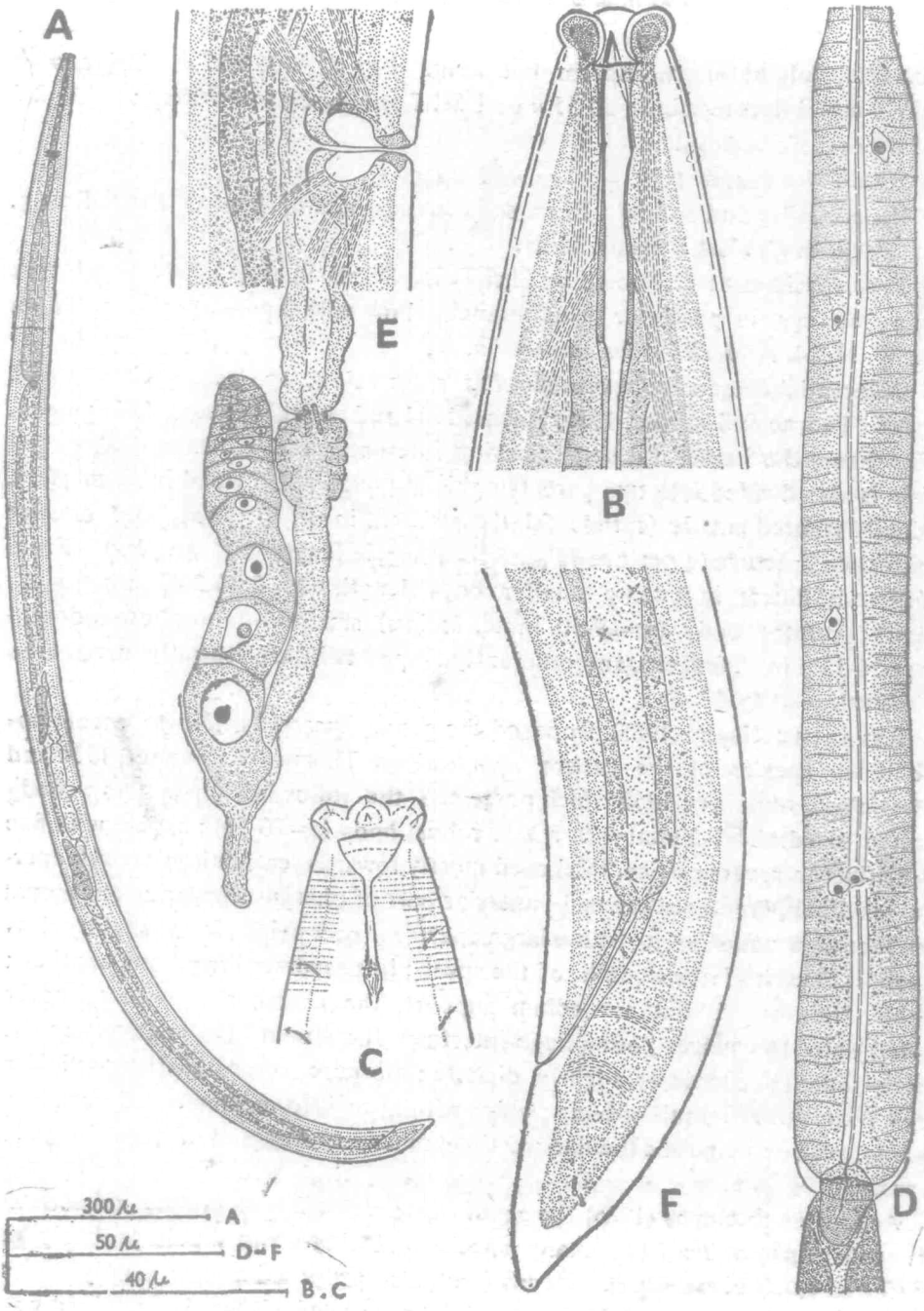
DO	= 46.6-48.6	S_1N_1	= 58-61	S_2N	= 85
DN	= 49 4-53.8	S_1N_2	= 73-74	S_2O	= 86
DO-DN	= 2.8-5.2	dist.	= 12.6-15.2		

K = 37-43 K' = 44-50

Nerve ring 140-148 μ or 29-33% of neck region from anterior end. Cardia tongue shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 76-122 μ or 2.3-3.8 anal body width long. Rectum 32-42 μ or 1.0-1.3 anal body width long.

Vulva a transverse slit. Vagina 21-25 μ or 1/2.3-1/2.4 of the corresponding body width long ; with moderately sclerotized distal region. Gonads amphidel-

* Named in honour of Prof. Dr. A. Coomans



Text-fig. 2—*Aprocelaimellus coomansi* n. sp.

A - Entire female ; B - Anterior region ; C - Surface view of anterior region D - Basal ; expanded portion of oesophagus, oesophageal gland nuclei and orifices ; E - Vulva region and posterior gonad ; F - Posterior end.

phic, typical, and short. Sperm not seen. Egg size 106×37 μ. Tail convex -conoid with blunt terminus, 50-55 μ or 1.5-1.7 anal body width long ; with 2-3 caudal pores on each side.

Male : Not found.

Type locality and habitat : From soil around roots of banana from Reang, Dist. Darjeeling (West Bengal), India.

Type specimens : Collected by Shri T. D. Soota in July, 1974 ; holotype (having an egg in posterior sexual branch) along with 3 paratypes mounted on slide W. N. 84, *Aporcelaimellus coomansi n. sp.*

Differential diagnosis : *Aporcelaimellus coomansi* n. sp. comes close to *A. simplex* (Thorne & Swanger, 1936) Heyns, 1965 and *A. indicus* Baqri & Jairajpuri, 1968. From the former it differs in having differently shaped amphidial pouch which is also divided into two parts (amphidial pouch not divided in *A. simplex*), distinctly striated cuticle (cuticle faintly striated in *A. simplex*), and smaller odontostyle aperture (a perture 75% of odontostyle length in *A. simplex*). From *A. indicus* it differs in having smaller body length (L=2.40-2 45 mm in *A. indicus*) ; stouter body (a=49-50 in *A. indicus*), smaller odontophore (odontophore 34-35 μ in *A. indicus*), and differently shaped tail (tail ventrally arcuate in *A. indicus*).

REMARKS : Heyns (1965) proposed the genus *Aporcelaimellus* to accommodate those species of the genera *Aporcelaimus* Thorne & Swanger, 1936 and *Eudorylaimus* Andrássy, 1959 which possessed the following characters : Body medium sized (L=1-3 mm) with rather robust body (a=20-30) ; cuticle with fine but distinct transverse striae, thickened mostly towards extremities ; oral aperture small, apparently hexagonal ; anterior part of pharynx appearing hexagonal in *en face* view ; axial spear with a large aperture, occupying from slightly less to more than half the length of the spear ; lips separated from one another ; amphid with or without a medium support, the chamber apparently never divided into two halves ; oesophago-intestinal disc absent ; tail relatively short, bluntly rounded, conoid or slightly digitate ; obscure ventro-median cuticular pores over entire length of body ; vulva with a small to medium-sized pore-like opening, with or without cuticularized lips ; mostly two eggs at a time in each uterus.

According to Heyns (1965) the genus *Aporcelaimellus* is closely related to the genus *Aporcelaimus* and many species of *Eudorylaimus* should probably be transferred to *Aporcelaimellus*. Heyns (l. c.) also proposed a new family *Aporcelaimidae* and stated that in none of the species of this family examined was there a sclerotized fixed ring at the anterior attachment of the guiding sheath.

The diagnosis of the genus *Aporcelaimellus* given by Heyns was based solely on a study of *A. obscurus* (Thorne & Swanger, 1936) Heyns, 1965. However,

the following other details have been observed in many *Aporcelaimellus* species : i) Baqri & Coomans (1973) have observed that the amphidial pouch is divided in three parts by clear lines in *A. kikereensis* Baqri & Coomans, 1973. The amphidial pouch of *A. coomansi* n. sp. is also divided, but in two parts, by a faint line ii) The presence of oesophago-intestinal disc was first reported by Baqri & Jairajpuri (1968) in *A. heynsi* Baqri & Jairajpuri, 1968 and *A. indicus* Baqri & Jairajpuri, 1968. This has been confirmed by Tjepkema *et al.* (1971) even in type (*A. obscurus*) and other species. iii) Vulva, a transverse slit, has been confirmed by Tjepkema *et al.* (1971), Baqri & Coomans (1973) and in the present two new species. iv) The presence of two eggs in each uterus in all the species of *Aporcelaimellus* is a very unreliable diagnostic character for a taxon. v) Absence of sclerotized fixed ring at the anterior attachment of the guiding sheath should not be considered a valid character because Goodey (1961) has pointed out that the guiding apparatus has the same basic structure in all dorylaims. Coomans (1963), while agreeing with Goodey's observations, has described the detailed structure and mechanism of movement of guiding sheath with the stylet. He (l. c.) also has shown that the sclerotized fixed ring and attached guiding sheath are easily distinguishable when the stylet is protruded. Furthermore, Coomans & van der Heiden (1971) have confirmed the presence of sclerotized fixed ring in both *Aporcelaimus* and *Aporcelaimellus* ; this ring, however, is said to be not as heavily sclerotized as in most of the dorylaims.

Tjepkema *et al.* (1971) reviewed the genus *Aporcelaimellus*. They have expressed that the genus *Aporcelaimellus* of the family Aporcelaimidae, apart from being close to genus *Aporcelaimus*, is also close to the genus *Eudorylaimus* of the family Dorylaimidae. According to Tjepkema *et al.* (l.c.) the genera *Aporcelaimellus* and *Eudorylaimus* differ from each other in the following characters :

Aporcelaimellus	*Eudorylaimus*
1. Mostly three cuticular layers.	Mostly two cuticular layers.
2. Lips separated from body by a deep constriction.	Lips not separated from body by a deep constriction.
3. Spear apertures 50% or more of spear length.	Spear aperture less than 50% (with a few exceptions) of spear length.
4. Amphids duplex in most species.	Amphids not duplex, except in *E. productus*.

Regarding the number of cuticular layers it is to be noted that the number of cuticular layers, two or three, is not an important character to differentiate the two genera. Studies on cuticle of various groups of nematodes through electron microscope have revealed that cuticle is a multilayered structure, but mainly divided in three layers, i.e., outer (cortical) ; a middle layer (matrix), and an inner layer (basal). Only in some parasitic nematodes the median layer is

lacking. Under compound microscope the visibility of cuticular layers depends upon the thickness of cuticle.

Sometimes a sheath supporting the amphidial pouch, which is certainly not a part of amphidial pouch, is present at the base of the latter ; such condition has been called a duplex amphid. Since this additional sheath is not a part of amphidial pouch, we consider not to use this terminology. Anyhow, such additional sheath has not been observed in *Aporcelaimellus* spp. by Baqri & Jairajpuri (1968) ; Baqri & Coomans (1973) ; and in the present two new species.

As pointed out by Tjepkema *et al.* (1971), we also think that the genus *Aporcelaimellus* is closely related to *Aporcelaimus* and *Eudorylaimus* and there is a need of complete revision of these three genera. Perhaps the genus *Aporcelaimellus* is intermediate between the other two genera.

We are of the opinion that apart from other characters, the location of oesophageal gland nuclei and their orifices should also be considered important characters to separate the genus *Aporcelaimellus* from *Eudorylaimus*. Loof & Coomans (1970) have convincingly shown that the location of oesophageal gland nuclei and their orifices is a constant feature in different groups. They (l.c.) have also demonstrated the differences in the arrangement or values of DO, DN, S_1N_1, S_1N_2, S_2N and S_2O among the various members of the families Dorylaimidae and Aporcelaimidae. Baqri & Coomans (1973) have also reported the locations of all the five oesophageal gland nuclei and their orifices in *Eudoryloimus granuliferus*, *Aporcelaimellus obtusicaudatus* and *A. kikereensis*. It is evident from the above observations as well as from the study on the present two new species that the distance between S_1N_1 and S_1N_2 is larger in *Aporcelaimellus* spp. than in the *Eudorylaimus* spp. The range of distance, between S_1N_1 and S_1N_2 calculated in percentage of neck length, in *Aporcelaimellus* and *Eudorylaimus* is 4.2-15.2 and 0.3-4.0 respectively.

Heyns (1965) and Tjepkema *et al.* (1971) have expressed the opinion that some other species of the genus *Eudorylaimus* could also be considered to belong to *Aporcelaimellus*. Tjepkema *et al.* (l.c.), because of close relationship, have compared *A. obscurus* with *E. pycnus*, *E. papillatus* and *E. quietus* ; *A. amylovorus* with *E. subsimilis* ; *A. simplex* with *E. insiginis* and *E efficiens* ; *A. propinquus* with *E. duhouxi and E. productus* ; *A. adoxus* with *E. subsimilis* and *E. efficiens* ; *A. hylophilus* with *E. samercandicus* ; *A. laevis* with *E. duhouxi*, *E. nothus*, *E. submissus* and *E. vitrinus*.

We are of the opinion that there is a strong case for transfer of these species of *Eudorylaimus* to the genus *Aporcelaimellus* and as such we propose the following new combinations :

Aporcelaimellus duhouxi (Altherr, 1963) n. comb.

Syn : *Eudorylaimus duhouxi* Alther, 1963

Aporcelaimellus efficiens (Cobb in Thorne & Swanger, 1936) n. comb.

Syn : *Eudorylaimus efficiens* (Cobb in Thorne & Swanger, 1936) Andrássy, 1959
Dorylaimus efficiens Cobb in Thorne & Swanger, 1936

Aporcelaimellus insiginis (Loos, 1945) n. comb.

Syn : *Eudorylaimus insiginis* (Loos, 1945) Andrássy, 1959.
Dorylaimus insiginis Loos, 1945

Aporcelaimellus nothus (Thorne & Swanger, 1936) n. comb.

Syn : *Eudorylaimus nothus* (Thorne & Swanger, 1936) Andrássy, 1959
Dorylaimus nothus Throne & Swanger, 1936

Aporcelaimellus pipillatus (Bastian 1865) n. comb.

Syn : *Eudorylaimus papillatus* (Bastian, 1865) Andrássy, 1959
Dorylaimus papillatus Bastian, 1865
Dorylaimus domus-glauci Cobb, 1893

Aporcelaimellus productus (Thorne & Swanger, 1936) n. comb.

Syn : *Eudorylaimus productus* (Thorne & Swanger, 1936) Andrássy, 1959
Dorylaimus productus Thorne & Swanger, 1936

Aporcelaimellus pycnus (Thorne, 1939) n. comb.

Syn : *Eudorylaimus pycnus* (Thorne, 1939) Andrássy, 1959
Dorylaimus pycnus Thorne, 1939

Aporcelaimellus quietus (Kirjanova, 1951) n. comb.

Syn : *Eudorylaimus quietus* (Kirjanova, 1951) Andrássy, 1959
Dorylaimus quietus Kirjanova, 1951

Aporcelaimellus samercandicus (Tulaganov, 1949) n. comb.

Syn : *Eudorylaimus samercandicus* (Talaganov, 1949) Andrássy, 1959
Dorylaimus samercandicus Tulaganov, 1949

Aporcelaimellus submissus (Kirjanova, 1951) n. comb.

Syn : *Eudorylaimus submissus* (Kirjanova, 1951) Andrássy, 1959
Dorylaimus submissus Kirjanova, 1951

Aporcelaimellus subsimilis (Cobb, 1893) n. comb.

Syn : *Eudorylaimus subsimilis* (Cobb, 1893) Andrássy, 1959
Dorylaimus Cobb, 1893

Aporcelaimellus vitrinus Thorne & Swanger, 1936) n. comb.

Syn : *Eudorylaimus vitrinus* (Thorne & Swanger, 1936) Andrassy 1959
Dorylaimus vitrinus Thorne & Swanger, 1936

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NEMATODES FROM THE ANDAMANS AND CAR NICOBAR ISLAND (INDIA)

BY

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Hoplolaimus sheri Suryawanshi, 1971 has been redescribed with some variations. *Discolaimium clavatum* n. sp., 1.05-1.16 mm long; odontostyle 10-12 μ; odontophore 18-20 μ; tail slightly clavate, rounded, 19-22 μ long; and males unknown. *Axonchium shamimi* n. sp., 1.35-1.58 mm long; odontostyle slightly fusiform, 8-9 μ; odontophore 12-13 μ, anterior sexual branch simple, sac-like, 2.4-3.0 vulva body-widths long; tail obtusely rounded, 23-27 μ long; and males unknown. Besides, 22 known species belonging to the orders Tylenchida, Dorylaimida and Mononchida have been reported.

During the year 1974, a number of parties from the Zoological Survey of India carried out a faunistic survey of the Andamans and Car Nicobar Island. Altogether 25 soil samples from different localities and host plants were collected. 25 species, 23 known and two new, belonging to the orders Tylenchida, Dorylaimida and Mononchida are being reported (Table I).

The nematodes were fixed in hot 4% formalin, dehydrated slowly in a desiccator and mounted in anhydrous glycerine. The type and other identified specimens have been labelled and deposited with the National Zoological Collections, Zoological Survey of India.

Hoplolaimus sheri Suryawanshi, 1971
(Fig. 1)

Measurements:

♀♀(7): L = 1.23-1.45 mm; a = 28-40; b = 8.1-9.6; b′ = 6.5-8.1; c = 49-60; V = 52-60; O = 9.0-11.5.

Description:

Body ventrally arcuate or 'C' shaped upon fixation, tapering slightly anterior to oesophago-intestinal junction. Transverse striae about 2 μ [1]) apart. Lateral field marked only by a single incisure.

Head distinctly set off from body, conical with a slight depression at apex, marked with 4 annules. Basal annule of lip region marked with 16-17 longitudinal lines (2 *en face* views). Spear 42-45 μ, robust; its metenchium 22-23 μ or 51-52% of spear length. Base of spear with three distinct anteriorly pointed indented knobs, 7-8 μ wide. Median bulb 18-21 × 16-17 μ at 54-61% of the total oesophageal length from anterior extremity. Oesophageal glands with six distinct

[1]) μ should be read as μm.

TABLE I

Other known species of nematodes from the Andamans and Car Nicobar island

Order	*Nematode species*	*Locality(ies)*	*Host(s)*
Tylenchida	*Tylenchorhynchus martini* Fielding, 1956	Havelock (Andamans)	Paddy
	T. nudus Allen, 1955	Maya Bander (Andamans)	Paddy & Banana
	Quinisulcius curvus (Williams, 1960) Siddiqi, 1971	Govt. Agriculture Farm (Car Nicobar)	*Abelmoschus esculentus*
	Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956	Havelock, Neill & Long Islands (Andamans)	Banana
	H. crenacauda Sher, 1966	Havelock (Andamans)	Paddy
	H. exallus Sher, 1966	Govt. Agriculture Farm (Car Nicobar)	*Solanum melongena*
	Aphelenchus avenae Bastian, 1865	Havelock, Chiriatapu (Andamans) & Govt. Agriculture Farm (Car Nicobar)	Banana *Abelmoschus esculentus*
Dorylaimida	*Eudorylaimus sabulophilus* Tjipkema, Ferris & Ferris, 1971	Havelock (Andamans)	Banana
	Thornenema mauritianum (Williams, 1959) Baqri & Jairajpuri, 1967	Maya Bander (Andamans)	Paddy
	Discolaimus major Thorne, 1939	Govt. Agriculture Farm (Car Nicobar)	*Abelmoschus esculentus*
	Aporcelaimellus paraconicaudatus (Meyl, 1956) Heyns, 1965	Maya Bander (Andamans)	Paddy
	A. heynsi Baqri & Jairajpuri, 1968	Havelock (Andamans)	Paddy
	A. porcus Thorne, 1974	Govt. Agriculture Farm (Car Nicobar)	*A. esculentus* & *S. melongena*
	Nygolaimus (*Claviicaudoides*) *trophurus* Heyns, 1968	Maya Bander (Andamans)	Paddy
	N. (*Solididens*) *bisexualis* Thorne, 1930	Neill (Andamans)	Banana
	Xiphinema elongatum Schuurmans Stekhoven and Teunissen, 1938	Havelock (Andamans)	Paddy
	Dorylaimoides bulbosus (Brzeski & Szczygiel, 1961) Szczygiel, 1965	Govt. Agriculture Farm (Car Nicobar)	*Abelmoschus esculentus*
	D. arcuatus Siddiqi, 1964	Chiriatapu (Andamans)	Banana
	D. pakistanensis Siddiqi, 1964	Neill Island, Long Island, Maya Bander (Andamans) & Govt. Agriculture Farm (Car Nicobar)	Banana *Abelmoschus esculentus*
	Dorylaimellus discocephalus Siddiqi, 1964	Govt. Agriculture Farm (Car Nicobar)	*Solanum melongena*
	D. belondivelloides Siddiqi, 1968	Havelock (Andamans)	Paddy
Mononchida	*Mylonchulus hawaiensis* (Cassidy, 1931) Andrassy, 1958	Long Island Neill Island (Andamans) & Govt. Agriculture Farm (Car Nicobar)	 Banana *S. melongena* & *A. esculentus*

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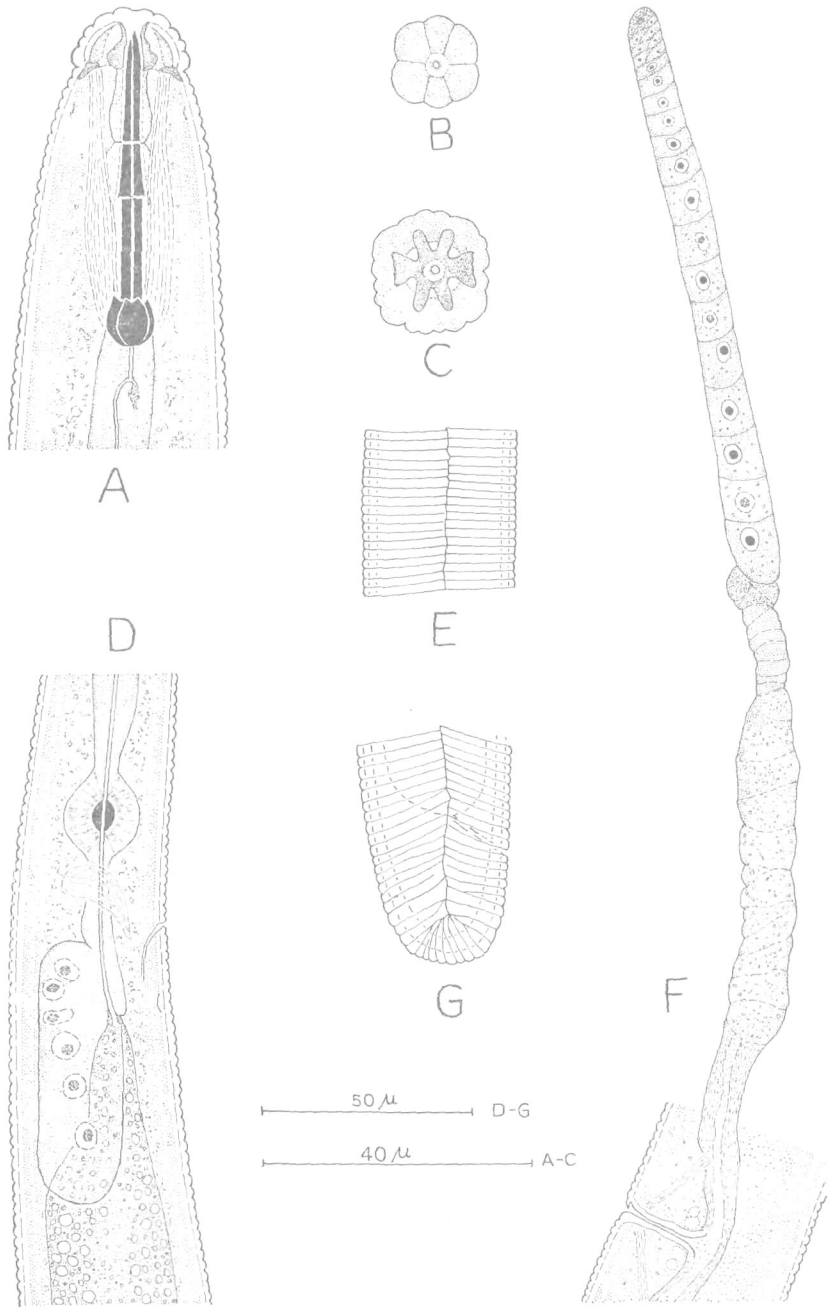

Fig. 1. *Hoplolaimus sheri* Suryawanshi, 1971. A - Head end; B - *En face* view; C - Cross section through basal annule of lip region; D - Posterior oesophageal region; E - Surface view at mid-body; F - Vulva region and anterior gonad; G - Tail.

nuclei. Orifice of dorsal oesophageal gland 4-5 μ from base of spear. Oesophago-intestinal valve distinct. Nerve ring 108-124 μ from anterior extremity. Intestine does not overlap rectum.

Excretory pore usually located posterior to nerve ring, but may be slightly anterior to the nerve ring, 106-133 μ from anterior end. Hemizonid 5-9 annules posterior to excretory pore, 2 annules wide. Anterior pair of cephalids 3 annules below lip region. Posterior pair of cephalids not seen. Anterior scutellum 28-36% of body length from anterior end, posterior 74-83%.

Gonads typical. Spermatheca non-functional without sperm. Oöcytes arranged in single row, except in anterior region. Epiptygma single, attached anteriorly or posteriorly. Tail rounded 22-29 μ long with 10-14 annules ventrally.

Male: Unknown.

Locality and habitat: Soil around roots of banana from Havelock Island, Andamans, India.

Remarks: Since the type specimens of *Hoplolaimus sheri* were not made available, the present population has been tentatively identified as *H. sheri*. However, some differences have been observed which, at present, are considered as intra-specific variations. These are:

The basal annule of lip region marked with 16-17 logitudinal lines, only a single incisure in mid-body, distinct hemizonid and six nuclei in the oesophageal glands (from Suryawanshi's (1971) description: the basal annule of lip region marked with 20 longitudinal lines, lateral fields aerolated and marked by two incisures in mid-body, hemizonid obscure and five nuclei in the oesophageal glands).

Discolaimium clavatum n. sp.
(Fig. 2)

Measurements:

Holotype ♀: L = 1.11 mm; a = 37; b = 4.5; c = 55; V = 6436.

Paratype ♀♀ (12): L = 1.10 mm (1.05-1.16 mm); a = 36 (31-39); b = 4.4 (4.0-4.6); c = 54.5 (50-61); V = 6·3 (6·7) 42 (38-44) 7 (6·8).

Description: Body ventrally curved slightly in the posterior half, tapering slightly towards both extremities. Cuticle finely striated transversely, its thickness 1-2 μm in mid-body and 2-3 μm at tail. Lateral chords 1/9th-1/7th of body-width near middle. Lateral glandular organs irregular in size and arrangement, 48-59 in number of which 10-14 in oesophageal region, 8-11 between base of oesophagus and vulva, 30-38 between vulva and anus and one in tail region. Lateral, ventral and dorsal body pores not distinct.

Lip region set off, slightly wider than adjoining body, 1/3.2-1/2.7 of body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying about 5 μm or 46-48% of the corresponding body-width, located 4-5 μm from anterior extremity. Sensillar pouches 15-17 μm from amphidial aperture.

Odontostyle 10-12 μm or 0.9-1.1 head-width long; aperture 45-50% of its

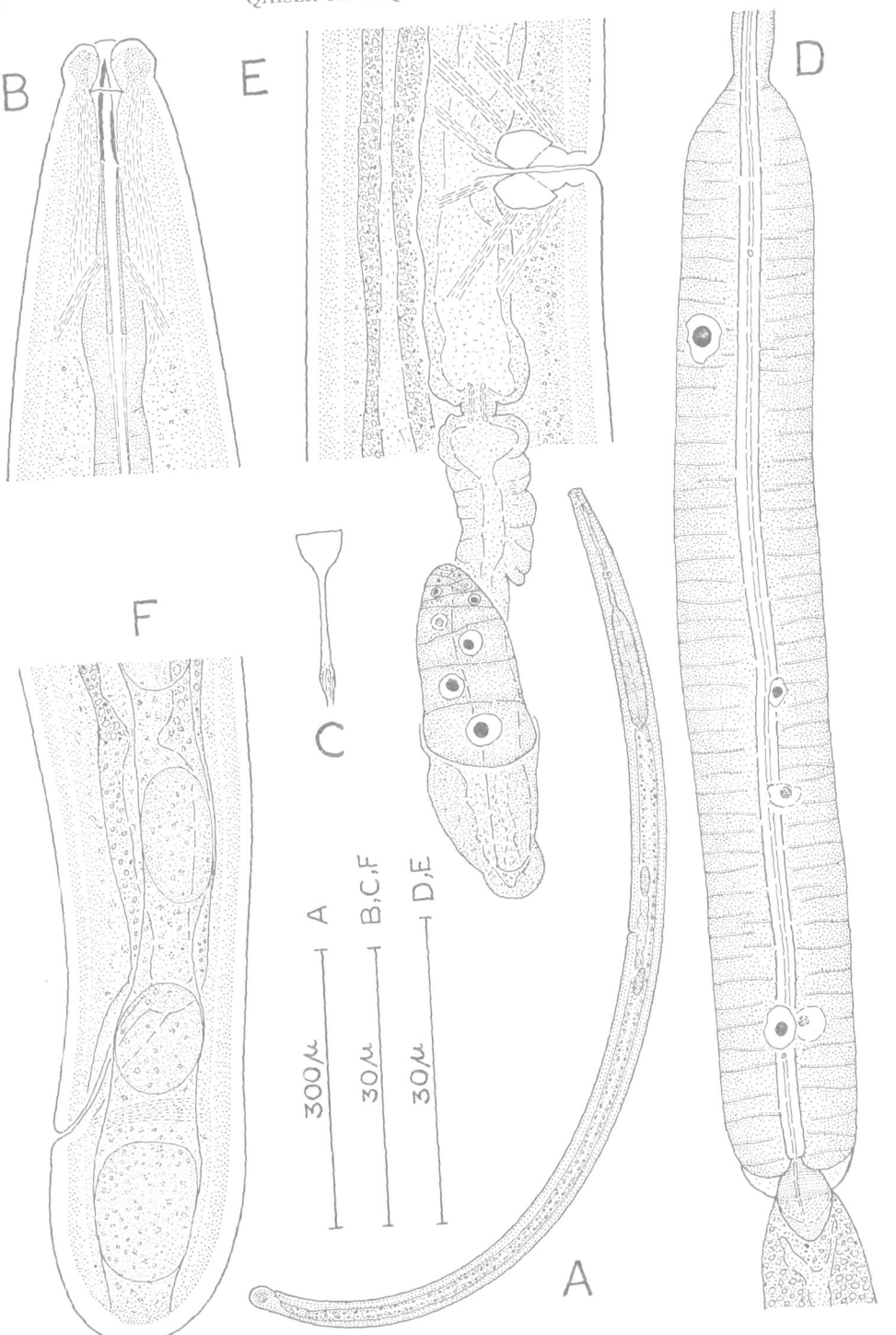

Fig. 2. *Discolaimium clavatum* n. sp. A - Entire female; B - Anterior region, C - Amphid with sensillar pouch; D - Basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; E - Vulva region and posterior gonad; F - Tail region.

length. Guiding ring 5-6 μm or about 1/2 head-width from anterior extremity. Odontophore 18-20 μm or 1.6-1.8 times the odontostyle length. The anterior slender part of oesophagus becomes narrower before joining basal expanded part. The basal expanded part occupies 47-54% of the neck region. Location of oesophageal gland nuclei and their orifices, visible only in two specimens, as follows:

DO = 60.2-62.3	S_1N_1 = 78-80	S_2N = 92-93
DN = 63.3-66.3	S_1N_2 = 82-83	S_2O = 94-95
DO-DN = 3.1 - 4.0		

K = 70-79 K′ = 74-83

Nerve ring 83-95 μm or 35-39% of neck region from anterior end. Cardia conoid with rounded terminus, surrounded with intestinal tissue. Oesophagointestinal disc well developed. Prerectum 30-40 μm or 1.5-2.0 anal body-width long. Rectum 15-19 μm, slightly less than one anal body-width long.

Vulva a transverse slit. Vagina 11-13 μm or 1/3-1/2.4 of the corresponding body-width long. Gonads amphidelphic, typical. Uterus and oviduct separated by sphincter. Sperm not seen.

Tail rounded, slightly swollen, 19-22 μm or 1.0-1.2 anal body-width long.

Male: Not found.

Type locality and habitat: From soil around roots of banana, Long Island, Andamans, India.

Type specimens: Collected by Dr. G. C. Rao in April, 1974; holotype along with one paratype mounted on slide WN 114, other paratypes on slides WN 115-118.

Differential diagnosis: *Discolaimium clavatum* n. sp. comes close to *D. brachyurum* Husain and Siddiqi, 1967 and *D. cylindricum* Thorne, 1939. From *D. brachyurum* it differs in having a differently shaped lip region, fewer glandular organs, a longer prerectum and swollen tail (lip region wider and separated from body by a deep constriction, glandular organs more than 70, prerectum one or less anal body-width long in *D. brachyurum*). It further differs from *D. brachyurum* in having a narrower anterior oesophagus. From *D. cylindricum* it differs in having a shorter body, differently shaped lip region, vagina and tail (L = 1.3 mm; lips angular, separated from body by a deep constriction; and tail somewhat convex-conoid, tapering to the blunt or rounded terminus in *D. cylindricum*).

Thorne (1939) has reported a distinct constriction setting off the anterior part of oesophagus only in the Colorado population of *D. cylindricum*.

Axonchium shamimi *) n. sp.
(Fig. 3)

Measurements:

Holotype ♀: L = 1.46 mm; a = 36; b = 2.8; c = 56; V = 65513.

*) Named after Dr. M. Shamim Jairajpuri, Reader in Zoology, Aligarh Muslim University, Aligarh, India.

255 Paratype ♀♀ (4): L = 1.35-1.58 mm; a = 35-41; b = 2.8-3.0; c = 47-69; V = 6-851-5591-13.

Description:

Body slightly curved ventrally in posterior half, tapering towards both extremities, more markedly at the anterior end. Cuticle distinctly striated, its thickness 2-3 μm in mid-body and 6-9 μm at tail (thickest on tail tip). Lateral chords 1/12th-1/8th of body-width near middle. Lateral, ventral and dorsal body pores not distinct.

Lip region set off, 1/6-1/5 of body-width at base of oesophagus. Lip high and bluntly conoid, with outer and inner portions demarcated by a shallow depression. Amphids large, their apertures occupying about 6 μm or 80-85% of the corresponding body-width, and 4 μm from anterior extremity. Sensillar pouches 21-22 μm from amphidial apertures. Odontostyle slightly fusiform, 8-9 μm or 1.1-1.2 times the lip region-width long; aperture 3.5-4.0 μm or 42-47% of odontostyle length. Guiding ring 8-9 μm from anterior extremity. Odontophore 12-13 μm or 1.3-1.5 times the odontostyle length. Anterior portion of oesophagus quite muscular and 9-11 μm wide just in front of oesophageal constriction. The constriction is very clear (Fig. 3, D). Basal expanded part of oesophagus 56-64% of the total oesophageal length. Muscle bundles of oesophageal sheath straight. Nerve ring 108-122 μm or 21-25% of neck region from anterior end. Cardia tongue-shaped, surrounded by intestinal tissue, about 1/4th of the body-width long. Prerectum 153-184 μm or 5-6 anal body-width long. Rectum about one anal body-width long.

Vulva a transverse slit. The vaginal wall adjacent to vulva is not differentiated from the body cuticle, posterior half encircled by well developed sphincter. Vagina bent posteriad, 20-25 μm or slightly more than 1/2 of the corresponding body-width long. Anterior sexual branch a simple sac, 98-120 μm or 2.4-3.0 vulva body-width long. Posterior sexual branch typical. Uterus and oviduct separated by sphincter. Sperm not seen.

Tail obtusely rounded, 23-27 μm or 0.8-0.9 anal body-width long; with two caudal pores on each side.

Male: Not found.

Type locality and habitat: From soil around roots of banana, Neill Island, Andamans, India.

Type specimens: Collected by Dr. G. C. Rao in April, 1974; holotype along with one paratype mounted on slide WN 119, other paratypes on slides WN 120-121.

Differential diagnosis: *Axonchium shamimi* n. sp., comes close to *A. elegans* Jairajpuri, 1964, *A. nitidum* Jairajpuri, 1964, *A. sabulum* (Yeates, 1967) Coomans & Yeates, 1969, and *A. latespiculatum* Nair, 1973. From *A. elegans* it differs in having a less fusiform odontostyle, larger odontostyle aperture, longer odontophore, a differently shaped vagina, no males, and a longer tail (odontostyle aperture less than 1/5th of the odontostyle length, odontophore 10 μm, tail 18 μm long in *A. elegans*). It differs from *A. nitidum* in having a less fusiform odontostyle,

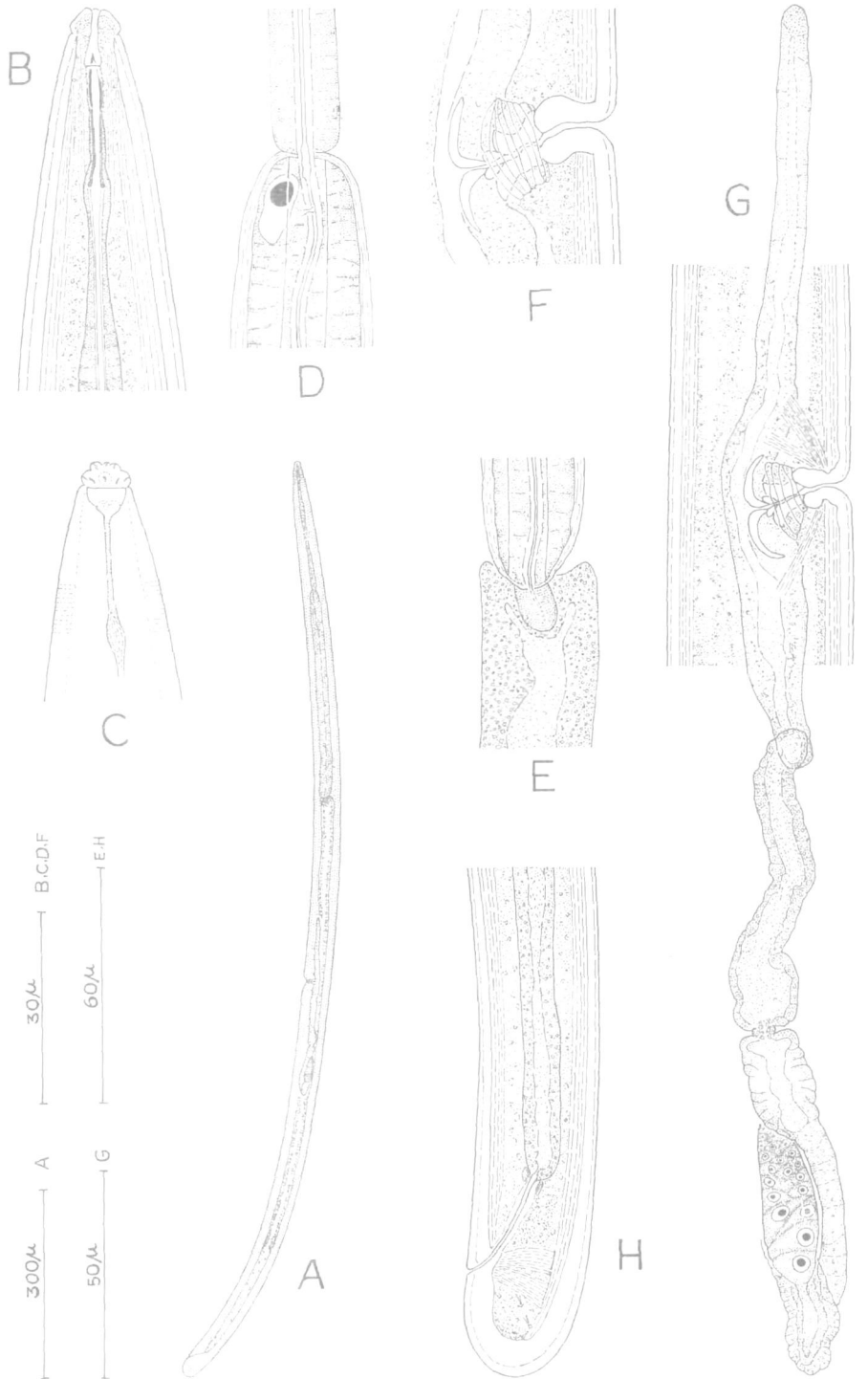

Fig. 3. *Axonchium shamimi* n. sp. A - Entire female; B - Anterior region; C - Surface view of anterior region; D - Oesophageal constriction; E - Oesophago-intestinal junction; F - Vulva region; G - Gonads; H - Tail region.

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longer anterior genital sac, differently shaped vagina, and two caudal pores (anterior genital sac about 1/2 the body diameter long, 3 caudal pores in *A. nitidum*). From *A. sabulum* it differs in having a shorter body, longer oesophagus, shorter odontostyle, the guiding ring more than one head-width from the anterior end, longer odontophore, and shorter prerectum (L = 1.8-2.1 mm, b = 3.6-4.2, odontostyle 11-13 μm, guiding ring at less than one head-width from anterior extremity, odontophore 15-17 μm, and prerectum 9-10 anal body-width long in *A. sabulum*). From *A. latespiculatum* it differs in having a shorter and thicker body, differently shaped lip region, a slightly fusiform odontostyle, the guiding ring more than one head-width from anterior extremity, a longer anterior sexual branch, shorter and obtusely rounded tail with two caudal pores (L = 1.9-2.2 mm, a = 48-55, lip region slightly narrower than adjoining body, cylindrical odontostyle, guiding ring less than one head-width from anterior extremity, anterior sexual branch less than two vulva body-width, tail cylindrical and more than one anal body-width with three caudal pores in *A. latespiculatum*).

RÉSUMÉ

Nématodes des Iles Andamans et Car Nicobar (Inde)

Hoplolaimus sheri Suryawanishi, 1971 est redécrit et certaines différences avec la population type notées. *Discolaimium clavatum* n. sp. est caractérisé de la façon suivante: longueur du corps: 1,05-1,16 mm; odontostyle: 10-12 μm; odontophore: 18-20 μm; queue arrondie, légèrement claviforme, longue de 19-22 μm; mâles inconnus. *Axonchium shamimi* n. sp. a les caractères suivants: longueur du corps: 1,35-1,58 mm; odontostyle légèrement fusiforme, long de 8-9 μm; odontophore 12-13 μm; branche génitale antérieure régressée, longue de 2,4-3,0 diamètres vulvaires; queue arrondie, longue de 23-27 μm; mâles inconnus.

En sus de ces trois espèces, 22 autres appartenant aux ordres des Tylenchida, Dorylaimida et Mononchida sont citées.

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A NEW SPECIES OF *DISCOLAIMIUM*, AND REMARKS ON THE SYNONYMY OF *DISCOLAIMIUM MAZHARI* WITH *DISCOLAIMIUM BRACHYURUM* (NEMATODA : DORYLAIMIDAE)

QAISER H. BAQRI and S. KHERA

Zoological Survey of India, Calcutta

ONE TEXT-FIGURE

ABSTRACT

A new species of *Discolaimium* belonging to the family Dorylaimidae, is described hereunder. It is unique in having an intermediate shape of the lip region between the genera *Discolaimus* Cobb, 1913 and *Discolaimium* Thorne, 1939 and comes close to *Discolaimium pseudoporum* Fielding, 1950. *Discolaimium mazhari* Baqri and Jairajpuri, 1968, has been synonymized with *Discolaimium brachyurum* Husain and Siddiqi, 1967.

INTRODUCTION

Very little is known about the nematodes associated with fruit trees in West Bengal, India. A collection of nematodes from soil around roots of the Banana in Reang, Darjiling District, West Bengal, contained a new species of the genus *Discolaimium* Thorne, 1939, which is described below.

After examining the type-specimens of *Discolaimium brachyurum* Husain and Siddiqi, 1967, it was felt that *Discolaimium mazhari* Baqri and Jairajpuri, 1968, is a synonym of the former.

We are thankful to Dr T. D. Soota, Superintending Zoologist, Zoological Survey of India, for collecting the soil samples from Reang, Darjiling District, West Bengal.

Discolaimium andrassyi, new species

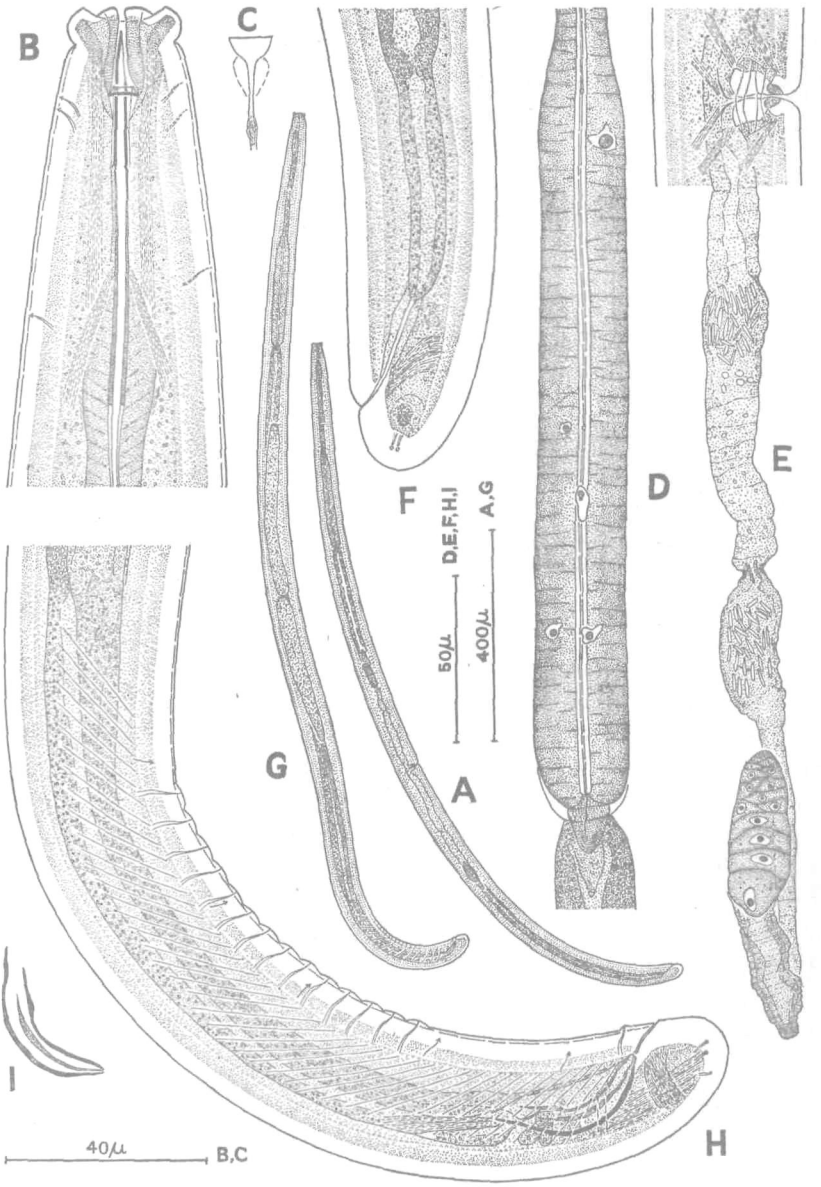
(Text-figure 1)

MEASUREMENTS: HOLOTYPE: ♀: L=1·50 mm; a=33; b=3·9; c=79, v=$^{165}41^{8}$.

PARATYPES: ♀: L=1·86 mm; a=30; b=4·0; c=89; v=$^{175}6^{17}$.

♂:L=1·74 mm; a=30; b=4·0; c=92; T=67.

DESCRIPTION: FEMALE: Body ventrally curved, slightly or even irregularly curved. Cuticle finely striated; its thickness 4-5μ in mid-body and 7-9μ at tail. Lateral chords about 1/5th the body-width near middle. Lateral glandular organs



TEXT-FIGURE 1.—*Discolaimium andrassyi* Baqri and Khera. **A**, entire famale; **B**, anterior body region; **C**, amphid; **D**, basal expanded portion of oesophagus, oesophageal gland nuclei and orifices; **E**, female posterior gonad; **F**, posterior body region of female; **G**, entire male; **H**, posterior body region of male; **I**, spicule.

not distinct. Lateral body-pores irregularly arranged along dorsal and ventral sides of lateral chords, 37-40 in number of which 11-12 in oesophageal region,

21-26 from cardia up to intestine-prerectum junction, 3-4 in prerectum and rectum region and 2-3 in caudal region. Dorsal and ventral body-pores 5-6 and 13-14 respectively.

Lip region well offset by a constriction, slightly wider than adjoining body, 1/2·8-1/2·3 of body-width at base of oesophagus. Amphids stirrup-shaped; apertures occupying 8-9μ or 42-43% of the corresponding body-width and 5-6μ from anterior extremity. Sensillar pouches 16-17μ from amphidial apertures.

Odontostyle 23-26μ or about 1·2 lip region-width long; aperture 8-9μ or 31-35% of its own length. Guiding ring 14-15μ or about 2/3rd of lip region-width from anterior end. Odontophore 39-44μ or about 1·5-1·7 times the odontostyle-length. Nerve-ring 130-152μ or 33-34% of neck region from anterior end. Basal expanded portion of oesophagus occupying 45-47% of total oesophageal length. Locations of oesophageal gland nuclei and orifices as follows:

DO = 54·1-57·5	S_1N_1 = 75-77	S_2N = 88-90
DN = 57·3-60·9	S_1N_2 = 80-82	S_2O = 89-92
DO-DN = 3·2- 4·6		
K=73-80	K′ =78-83	

Cardia tongue-shaped, enveloped by intestinal tissue. Oesphago-intestinal disc present. Prerectum 55-76μ or 1·6-2·5 anal body-width long. Rectum 32-42μ or 0·9-1·2 anal body-width long.

Vulva a transverse slit. Vagina 21-26μ or 1/2·4-1/2·1 of the corresponding body-width long, surrounded by a sphincter; with a moderately sclerotized distal region. Gonads amphidelphic, typical. Uterus and oviduct separated by sphincter; oöcytes arranged in a single row except at growth region.

Tail hemispheroid, 19-21μ or 0·6 anal body-width long; with 2-3 caudal pores on each side.

MALE: Similar to female in general shape and morphology except for more ventrally curved posterior part of the body. Male gonads typical. Spermatozoa elliptical, 6-7μ long. Spicules 52μ or about 1·7 anal body-width long with a simple median piece. Lateral guiding pieces rod-shaped, 8μ long. In addition to the adanal pair, 14 contiguous and regularly spaced ventromedian supplements present. Subventral papillae 5, spaced more or less equidistant. Copulatory muscles 43 in number, reaching anterior to supplement region.

Prerectum starting anterior to copulatory muscles, 245μ or about 8 anal body-width long. Tail hemispheroid, 19μ or about 0·6 anal body-width long; with 3 caudal pores on each side.

DIFFERENTIAL DIAGNOSIS: *Discolaimium andrassyi* described above, comes close to *D. pseudoporum* Fielding, 1950, but differs from it in having longer odontostyle with about 1/3rd aperture (odontostyle about 2/3rd of lip region-width with 1/2 aperture in *D. pseudoporum*); more posteriorly located guiding ring (less than 1/2 of

lip region-width from anterior end in *D. pseudoporum*); odontophore 1·5-1·7 times the odontostyle-length (odontophore 2 times the odontostyle-length in *D. pseudoporum*); basal expanded portion of oesophagus less than 1/2 of neck region (basal expanded portion of oesphagus 3/5th of neck region in *D. pseudoporum*); vagina with moderately sclerotized distal region and surrounded by sphincter (vagina without moderately sclerotized distal region and sphincter in *D. pseudoporum*).

Fielding (1950) tentatively placed *Discolaimium pseudoporum* under the genus *Discolaimium*, but mentioned that probably this species represents the group from which the genera *Discolaimium* and *Discolaimus* have evolved. *Discolaimium andrassyi* has the same shape of the lip region as has the genus *Discolaimus* but it is not expanded as much. Like *D. pseudoporum*, the present new species also probably represents the group from which these two genera were evolved.

MATERIAL: HOLOTYPE: ♀, on slide No. WN 100; fromReang, alt. 300m, Darjiling District, West Bengal, India; July 1974; soil collected by Dr T. D. Soota. Deposited with the National Zoological Collections, Zoological Survey of India, Calcutta.

PARATYPES: 1 ♀, 1 ♂, on slide No. WN 101. Other data as for the holotype.

TYPE-HABITAT: Soil around roots of the Banana.

REMARKS: One of us (Q.H.B.) has examined the type-specimens of *Discolaimium brachyurum* Husain and Siddiqi, 1967, and is convinced that *D. mazhari* Baqri and Jairajpuri, 1968 is a synonym of the former.

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NEMATODES OF HIGH ALTITUDES IN INDIA VI. *ENCHODELIUM THORNEI* SP. N. AND THE RELATIONSHIPS OF THE GENERA *ENCHODELIUM*, *OONAGUNTUS* AND *MALEKUS* (DORYLAIMIDA)

BY

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Enchodelium thornei sp. n. was collected from soil around the roots of *Riccia* sp. from Palampur and Mandi, Himachal Pradesh. Body 0.63-0.75 mm long ; odontostyle 10-11 µm long, attenuated ; female gonad mono-opisthodelphic ; tail elongate-conoid with its posterior third bent dorsally. The relationship of the genus *Enchodelium* Andrássy, 1963 with *Oonaguntus* Thorne, 1974 and *Malekus* Thorne, 1974 has been discussed.

Specimens belonging to the rare genus *Enchodelium* Andrássy, 1963 were collected by one of us (MSJ) during the survey of plant and soil nematodes of the Himalaya mountains in Himachal Pradesh during the year 1970. These specimens represent a new species of the genus for which the name *E. thornei* is proposed in honour of late Professor Gerald Thorne.

The genus *Enchodelium* was found to have close affinities with the genera *Oonaguntus* and *Malekus* described by Thorne (1974) especially in having small bodies, in the form of odontostyles, and in the shape of tails.

ENCHODELIUM THORNEI SP. N.

(Fig. 1, A-F)

15 ♀♀ (*Paratypes*) : L=0.68 (0.63—0.75 mm) ; a=26 (24—29) ; b=4.4 (4.1—4.8) ; c=9 (8—11) ; V= $^{0.7\ (0.6-0.9)}34\ (30-35^{12(8-15)}$

Female (*Holotype*) : L=0.64 mm ; a=26 ; b=4.1 ; c=9 ; V= $^{0.7}35^{11.}$

Body ventrally curved upon fixation, tapering slightly towards both the extremities. Cuticle finely striated transversely ; 1-2 µm thick at midbody and 2-3 µm on tail. Lateral chords 1/7th-1/4th of body width near middle.

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Lateral, ventral, and dorsal body pores inconspicuous. Lip region marked with a slight depression, 1/4th-1/3rd of body width at base of oesophagus. Amphids stirrup-shaped, located at about 3μm from anterior extremity ; apertures occupying 3-4 μm or 56-67% of the corresponding body width. Sensillar pouches 11-12μm from the amphidial apertures.

Odontostyle attenuated 10-11 μm or 1.6-1.8 lip width long ; its aperture minute, about 1μm. Guiding ring 6-8μm or 1.2-1.3 lip width from anterior extremity. Odontophore 14-17μm or 1.4-1.7 times the odontostyle length. The basal expanded portion of the oesophagus occupying 32-37% of the neck length. The location of oesophageal gland nuclei and their orifices is as follows :

DO	=66.2-71.5	S1N1=81-85	S2N=90-93
DN	=69.6-75.4	S1N2=83-86	S2O=92-95
DO-DN	=2.7-4.1	K=76-91	K'=89-93

Nerve ring 69-83μm or 45-51% of neck length from anterior extremity. Cardia short, enveloped by intestinal tissue. Oesophago-intestinal disc absent. Prerectum 34-50μm or about 2-3 anal body width long. Rectum 17-21μm or 1.1-1.3 anal body width long.

Vulva transverse. Vagina 9-11μm or 1/2.7-1/3.2 of the corresponding body width. Gonad mono-opisthodelphic ; anterior sexual branch represented only by a small anterior uterine sac which is 4-7μm or 1/6th-1/4th vulval body width in length. Posterior sexual branch typical, ovary reflexed with 12-18 oocytes ; oviduct with a distal narrow and a proximal swollen portions ; uterus elongated, separated from the oviduct by a well developed sphincter. Sperms not seen in the entire genital tract.

Male : Not found.

Type habitat and locality : Soil around roots of *Riccia* sp. from Palampur and Mandi, Himachal Pradesh, India.

Type specimens : Collected by M. Shamim Jairajpuri, October, 1970 ; holotype along with a paratype mounted on slide HA 1/*Enchodelium thornei* sp. n./1 ; paratypes (15) on slides HA 1/*Enchodelium thornei* sp. n./2-4.

The holotype and the paratypes on slides 2 & 3 are deposited in the Department of Zoology, Aligarh Muslim University, while the paratypes on slide No. 4 are deposited in the National Nematode Collection, Division of Nematology, Indian Agricultural Research Institute, New Delhi.

Diagnosis and relationships : Enchodelium thornei sp. n., comes closest to the type and only species *E. angolense* Andràssy, 1963 but differs from it in having

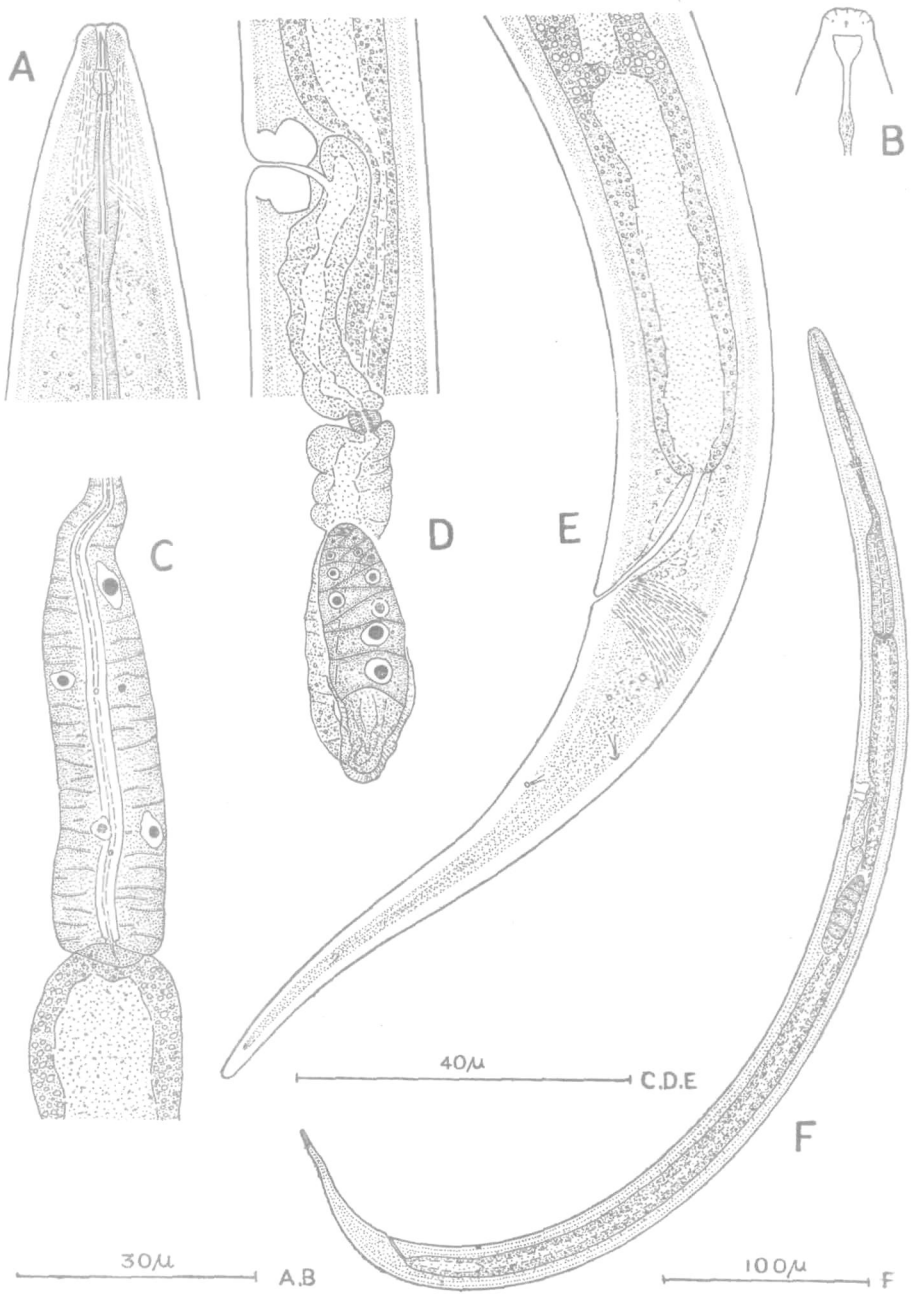

Fig. 1. *Enchodelium thornei* sp. n., female. A—Head end ; B—Head end showing amphid ; C—Expanded region of oesophagus showing oesophageal gland nuclei and their orifices ; D—Gonad ; E—Tail end, and F—Body entire.

shorter oesophagus (b=2.9-4.0 in *E. angolense*), very short cardia, differently shaped vagina, longer and differently shaped tail (tail ventrally curved and 3-4 anal body widths long in *E. angolense*).

DISCUSSION

Thorne (1974) proposed the genera *Oonaguntus* and *Malekus* under the subfamily Dorylaiminae (de Man, 1876) Filipjev, 1918. Both these genera have exceedingly thin and slender odontostyle with obscure aperture. While giving the definition of *Oonaguntus* he has also stated the possibility of a nygolaimoid type of spear without an aperture. He has observed that a close relationship exists between *Drepanodorylaimus macramphidius* Andrassy, 1971 and *Malekus acridens* Thorne, 1974 especially in the shape of head and the odontostyle and there are possibilities that the two probably represent a new subfamily of Dorylaimidae de Man, 1876. The reason why Thorne (l. c.) placed *Oonaguntus* and *Malekus* under Dorylaiminae was perhaps the similarity in the positions of the oesophageal gland nuclei and their orifices in these genera with those of the genus *Eudorylaimus* Andrássy, 1959.

While we agree that the genera *Oonaguntus* and *Malekus* are related to *Eudorylaimus*, they are more close to the genus *Enchodelium* Andrássy, 1963 especially in having small bodies, in the form of spear, and in tail shapes. We therefore propose that the genera *Oonaguntus* and *Malekus* should also be placed under the subfamily Pungentinae Siddiqi, 1969 of the family Dorylaimidae. We also feel that the form of odontostyle be given more importance as compared to the arrangement of the oesophageal gland nuclei unless there are distinct differences in the arrangement. Until more information becomes available which will perhaps only be possible when more species of these three genera are described, we prefer to place them under Pungentinae. Most probably these three closely related genera represent a subfamily group of their own.

Key to distinguish Enchodelium, Oonaguntus and Malekus

1. Female gonad mono-opisthodelphic.....*Enchodelium*
   Female gonads amphidelphic.....2
2. Lip region continuous, rounded and amalgamated.....*Oonaguntus*
   Lip region offset, labial papillae modifying the head contour.....*Malekus*

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NEMATODES FROM WEST BENGAL (INDIA) I. ON THE VARIATIONS IN TWO SPECIES OF DORYLAIMIDAE AND REDESCRIPTION OF *BELONDIRA NEORTHA* SIDDIQI, 1964 (BELONDIRIDAE).

By

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(With 3 Text-figures)

INTRODUCTION

During November-December, 1975 a survey was made to collect the soil samples from around roots of fruit trees, paddy and tea in the following three districts of West Bengal, *viz.* Cooch Behar, Jalpaiguri and Darjeeling. The analysis of these samples showed a wide variety of tylenchid, dorylaimid, mononchid and other soil inhabiting nematodes.

In this first paper on the series "Nematodes from West Bengal (India)", *Thornenema cavalcantii* (Lordello, 1955) Andrassy, 1959 and *Oriverutus sundarus* (Williams, 1964) Siddiqi, 1971 belonging to the family Dorylaimidae have been redescribed in detail and intraspecific variations have been noted. In one population of *Thornenema cavalcantii* the abnormal development of anterior sexual branch has also been reported. Since the original description of *Belondira neortha* Siddiqi, 1964 belonging to the family Belondiridae is based on a single female and a male, it was considered necessary to redescribe this species in detail.

For the sake of study of variations, three specimens of *Thornenema cavalcantii* from Sikkim (India) have also been included in the present study.

The nematodes were fixed in hot 4% formalin, transferred in glycerine-alcohol, dehydrated slowly in desiccator and mounted in anhydrous glycerine.

Thornenema cavalcantii (Lordello, 1955) Andrássy, 1959
(Text-fig. 1)

1955. *Dorylaimus cavalcantii* : Lordello, *Rev. Bras. Biol.*, **15** : 216
1964. *Thornenema cavalcantii* : Loof, *Nematologica*, **10** : 266
1965. *Thornenema cavalcantii* : Siddiqi, *Labdev J. Sci. Tech.*, **3** : 131

Measurements :

Matigrah population : Normal ♀ ♀ (4) : L = 0.99—1.12 mm; a = 27 — 32; b = 4.0 — 4.6; c = 11 — 12; V = $^{1.0-1.5}$ 41 — 45$^{11-12}$.

Abnormal ♀ ♀ (2) : L = 1.00 — 1.10 mm; a = 29 — 30; b = 4.2; c = 12; V = $^{6.5-7.5}$ 46 — 48 ^{12}.

Reang Testa population : ♀ ♀ (5) : L = 0.92 — 1.09 mm; a = 24 — 30; b = 4.0 — 4.6; c = 11 — 15; V = $^{1.2-1.8}$ 43 — 45 $^{13-16}$.

Lebong population : ♀ (1) : L = 1.16 mm; a = 28; b = 4.5; c = 12; V = $^{1.8}$ 44 ^{13}.

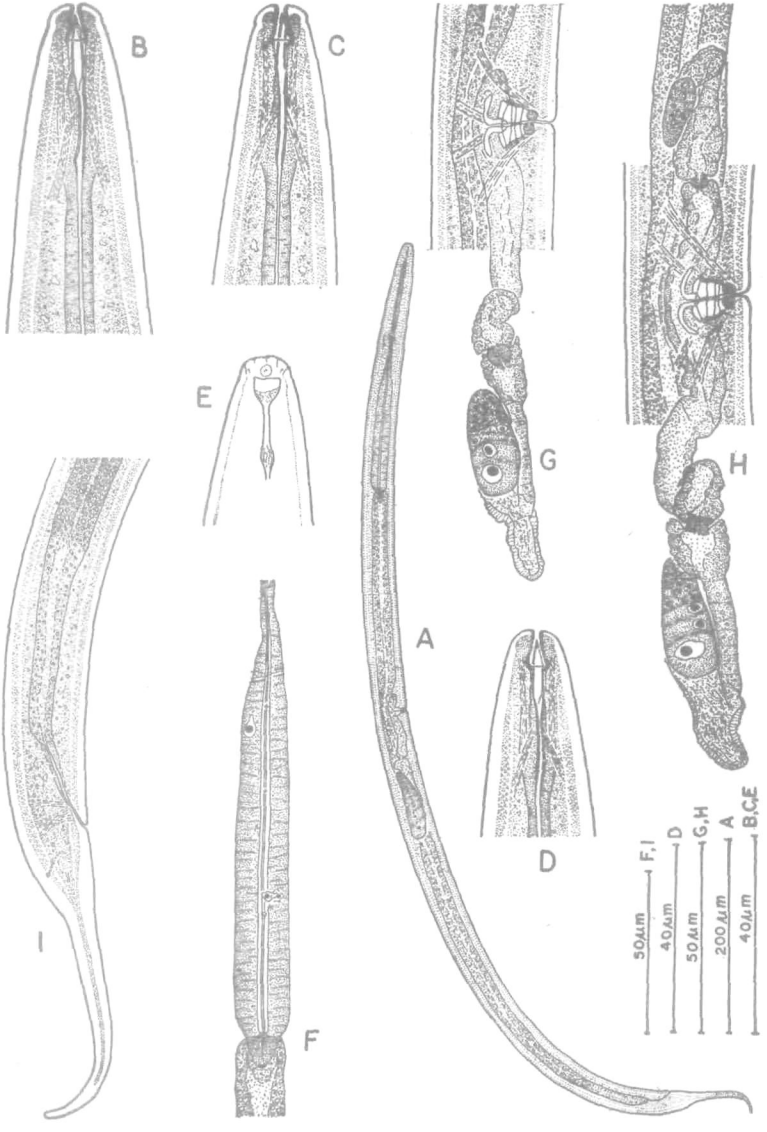
Sikkim population : ♀ ♀ (3) : L = 0.99 — 1.09 mm; a = 31 — 33; b = 3.9—4.3; c = 11 — 16; V = $^{1.3-2.1}$ 43 — 46 $^{11-14}$.

Description : Body slightly ventrally curved upon fixation, tapering somewhat towards both extremities. Cuticle finely striated transversely; its thickness 2 μm in mid-body and 4-5 μm at tail. Lateral chords granular, 1/7th — 1/5th of the body-width near middle. In some specimens the lateral glandular organs distinct, 14 — 22 in number, irregularly spaced, starting before base of oesophagus up to anus. Ventral, dorsal and lateral body pores not distinct.

Lip region usually marked with slight depression (Text-fig. 1, B), sclerotized, rounded, lips amalgamated; appears slightly offset when the specimen is in subdorso-lateral position (Text-fig. 1, C); continous with body in Sikkim population (Text-fig. 1, D); 1/3.6 — 1/3.0 of body-width at base of oesophagus. Amphids stirrup-shaped; apertures occupying 4 — 5 μm or 40-45% of the corresponding body-width and 4—5 μm from anterior extremity. Sensillar pouches 16-17 μm from amphidial apertures.

Odontostyle 11-13 μm or 1.1 — 1.2 lip region-width long; thickness about equal to corresponding body cuticle; aperture 4-5 μm or 35-42% of odontostyle length. Guiding ring 7-8 μm or 0.6-0.8 lip region-width from anterior extremity. Odontophore 15-18 μm or 1.2 — 1.5 times the odontostyle length. The anterior slender part of oesophagus gradually expands to form the basal expanded portion. The basal expanded portion of oesophagus occupying 46-49% of the neck region. The nuclei of first subventral pair of oesophageal glands are indistinct. Locations of oesophageal gland nuclei and their orifices as follows :

DO = 56.7—59.4 S_1O_1 = 68-72 S_2N = 81—82
DN = 60.0—62.8 S_2O = 83—84
DO—DN = 2.8—3.4



Text-fig. 1. *Thornenema cavalcantii.* A. Entire female. B. Anterior end in lateral view. C. Anterior end in subdorsolateral view. D. Anterior end in lateral view (Sikkim Population). E. Surface view of anterior end. F. Basal expanded part of oesophagus, oesophageal gland nuclei and their orifices. G. Normal female gonad. H. Abnormal development of anterior gonad. I. Posterior region.

Nerve ring 92-98 μm or 38-40% of neck region from anterior end. Cardia conoid with rounded tip, 8-11 μm long, enveloped by intestinal tissue. Prerectum 43-78 μm or 2.1-3.4 anal body-width long. Rectum 21-29 μm or 1.0—1.4 anal body-width long.

Vulva a transverse slit. Vagina extending inward 16-18 μm or about 1/2 of corresponding body-width, surrounded by sphincter, with moderately sclerotized distal region. Normally mono-opisthodelphic gonad. Anterior uterine sac rudimentary, 13-21 μm or about 1/3rd—2/3rd of corresponding body-width. Uterus and oviduct separated by sphincter; oöcytes arranged in a single row, except at growth region. Two abnormal specimens in Matigarh population are amphidelphic in which anterior sexual branch is also typical but reduced in size and length (Text-fig. 1, H). Sperm not seen. Egg 87-91 × 27-31 μm.

Tail elongate-conoid, posterior third bent dorsally with rounded terminus, 66-102 μm or 3.1—5.0 anal body-width long, with two caudal pores on each side.

Male: Not found.

Localities and habitats: Matigarh population: From soil around roots of Banana at Matigarh, 6 km from Siliguri on Siliguri-Darjeeling Road, District Darjeeling, West Bengal. Reang Testa population : From soil around roots of Banana at Reang Testa, District Darjeeling, West Bengal. Lebong population : From soil around roots of Banana at Lebong, District Darjeeling, West Bengal. Sikkim population: From soil around roots of Maize at Suntali, on the road to Singtom, Sikkim.

Remarks : Lordello (1955) originally described this species as *Dorylaimus cavalcantii* on a single female from Brazil. Andrássy (1959) transferred this species under his newly proposed genus *Thornenema* because of its amalgamated lip region, mono-opisthodelphic gonad and long tail. Loof (1964) reported two females from Venezuela and noted the following variations: longer and slender body (L = 1.15 — 1.25 mm against 0.99 mm and a = 35—36 against 26 in former), slightly offset lip region and not wholly rounded, wider lateral chords with the glands bulging less strongly and the absence of a constriction between oviduct and uterus. These differences were regarded by Loof (l.c.) as intraspecific variations. Siddiqi (1965) reported three females from India having more resemblance with the specimens from Venezuela except for the rounded and continuous lip region, thinner lateral chords (1/8th of body-width against 1/6th) and a constriction between uterus and oviduct.

The present study which is based on a larger number of specimens from 4 different localities reveals that the lip region is smoothly rounded, usually marked from the body by a slight depression or rarely continuous with body. The depression appears slightly deeper when the

specimen lies in subdorso-lateral position. The body length varies from 0.92—1.16 mm. The lateral chords vary from 1/7th—1/5th of body-width near middle, sometimes bearing irregularly spaced distinct lateral glandular organs. The uterus and oviduct are always separated by a well developed sphincter. Vagina is always moderately sclerotized distally, such sclerotization has hitherto not been described. The excretory pore, as reported by Loof (1964), could not be seen.

The amphidelphic condition of gonads in Matigarh population is being treated as an abnormality which does not warrant an emendation of diagnosis of the genus *Thornenema*.

Oriverutus sundarus (Williams, 1964) Siddiqi, 1971
(Text-fig. 2)

1964. *Eudorylaimus sundarus* : Williams, *Nematologica*, **10** : 319

Measurements : ♀♀ (3) : L = 0.88—0.98 mm; a = 24—28; b = 3.4—3.5; c = 19—21; $V = {}^{0.8}39 - 41^{12-16}$.

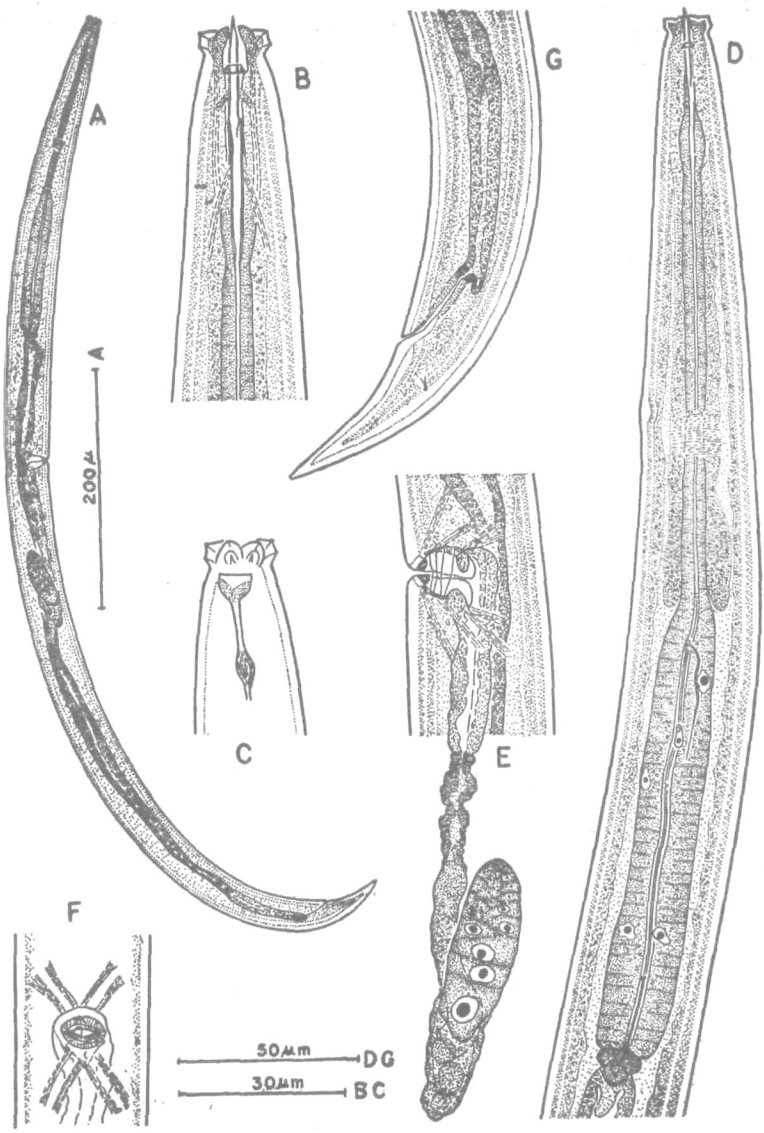
Description: Body ventrally curved in posterior half upon fixation, tapering gradually towards both extremities. Cuticle finely striated transversely; its thickness 2-3 μm in mid-body and 4-6 μm at tail. Lateral chords 1/9th—1/8th of body-width near middle. Ventral, dorsal and lateral body pores not distinct.

Lip region wider than adjoining body, marked by a distinct constriction from body, about 1/3rd of body-width at base of oesophagus; lip distinct, large, subangular. Amphids stirrup-shaped; apertures occupying 5-6 μm or 45-50% of the corresponding body-width, 5-6 μm from anterior extremity. Sensillar pouches 15-16 μm from amphidial apertures.

Odontostyle cylindrical, 16-17 μm or 1.4—1.5 lip region-width long, thickness slightly less than corresponding cuticle-width; aperture about 3 μm or 17-19% of odontostyle length. Guiding ring about 7 μm or 0.6 lip region-width from anterior extremity. Odontophore 19-21 μm or about 1.2—1.4 times the odontostyle length. The basal expanded part of oesophagus occupying 42-44% of neck region. Locations of oesophageal gland nuclei and their orifices as follows:

DO = 57.8—60.1	S_1N_1 = 68—70	S_2N = 88—91
DN = 61.7—64.1	S_1N_2 = 73—75	S_2O = 90—93
DO—DN = 3.9—4.0		
K = 54—59		K′ = 65-70

Distinct hemizonid present at 35-38% of neck region from anterior end. Nerve ring 102-106 μm or 35-41% of neck region from anterior end. Cardia with three lobes, enveloped by intestinal tissue. Prerectum 51-62 μm or 2.5—3.3 anal body-width long, with a lobe extending



Text-fig. 2. *Oriverutus sundarus*. A. Entire female. B. Anterior end. C. Surface view of anterior end. D. Neck region. E. Female gonad. F. Vulva in ventral view. G. Posterior region.

behind prerectum-rectum junction. Rectum 20-23 μm or 1.0—1.2 anal body-width long.

Vulva a transverse slit. Vagina extending inward 16-17 μm or slightly less than 1/2 of the corresponding body-width, moderately sclerotized distally. Mono-opisthodelphic gonad. Uterus and oviduct

separated by sphincter; oöcytes arranged first in single row, then in double rows and in multiple rows at growth region. Sperm not seen.

Tail ventrally curved, conoid, horn-shaped in profile with narrow blunt terminus, 47-48 μm or 2.3—2.5 anal body-width long with one caudal pore on each side.

Male: Not found.

Locality and habitat: From soil around roots of Tea at Mohargaon Tea Estate, District Darjeeling, West Bengal.

Remarks: The present specimens closely resemble with the original description of *O. sundarus* (Williams, 1964) except in having lips without prominent teat-like papillae, narrow and differently shaped amphids, distinct hemizonid, and tail with blunt terminus and not dorsally curved slightly near terminus. After Williams (1964) : Lips with prominent teat-like papillae, amphids occupying more than half (55% in Text-fig. 1, C) of corresponding body-width and are deeper, hemizonid not reported, and tail with sharply pointed terminus and slightly bent dorsally near terminus. Williams (l.c.) illustrated and described the position of guiding ring slightly less than one lip region-width from anterior end but Siddiqi (1971) illustrated the position of guiding ring from one of the paratypes at 0.65 lip region-width from anterior end. It is, therefore, evident that the position of guiding ring is also variable in the type specimens. The tail in the present population seems very similar in shape to that of type specimens except in the absence of a slight dorsal bent near the terminus which also does not appear to be prominent.

Except the shape of amphids and the lips without prominent teat-like papillae, the other characters are always variable within the species. Since there is no other justification to describe our specimens as new species, we prefer to consider all these differences as intraspecific variations.

Siddiqi (1971), while proposing the genus *Oriverutus*, stated that amphids are abnormally large and nucleus of dorsal oesophageal gland is comparatively smaller in size in all the species of this genus. Since amphidial apertures are about 50% of the corresponding body-width and the nucleus of dorsal oesophageal gland is of normal size in the present population of *O. sundarus*, Siddiqi's statement in the diagnosis of the genus *Oriverutus* may be emended.

This species is reported for the first time from India.

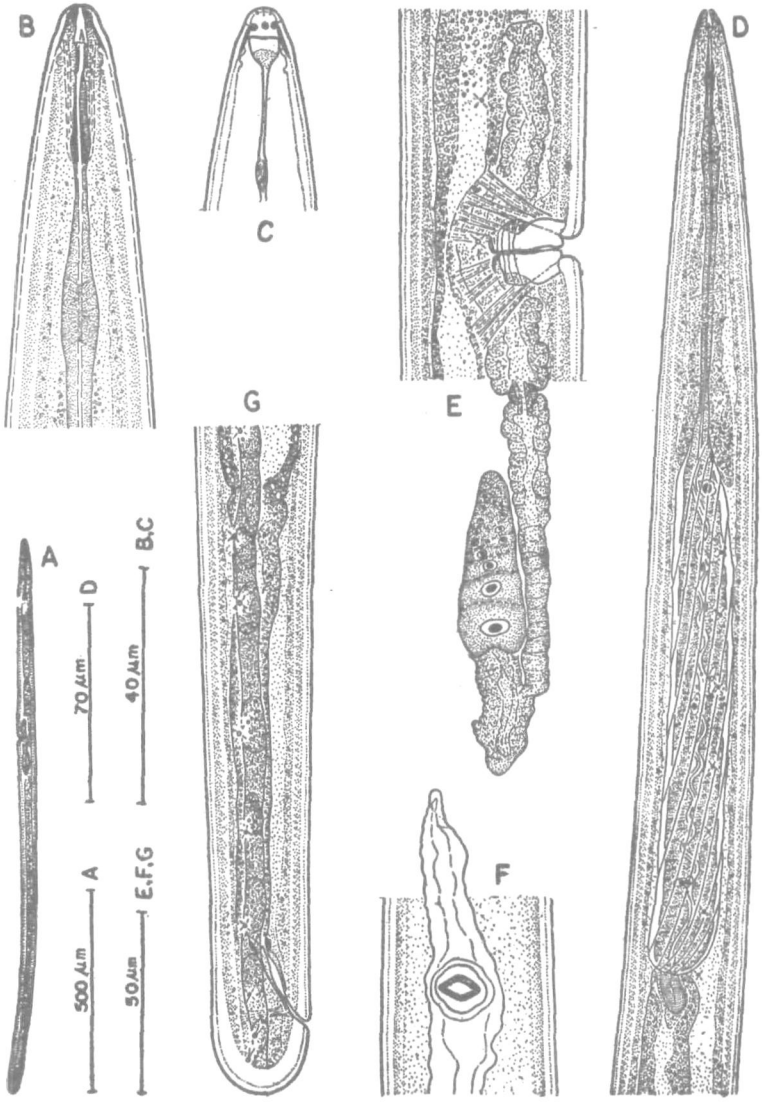
Belondira neortha Siddiqi, 1964
(Text-fig. 3)

1964. *Belondira neortha*: Siddiqi, *Labdev J. Sci. Tech*, **2** : 39.

Measurements :

Matigarh population: ♀♀ (8) : L = 1.36—1.51 mm; a = 27—33; b = 4.0—4.3; c = 68—78; V = $^{3.4-4.2}$ 35—38 $^{8-10}$.

Dagapur population: ♀♀ (3) : L = 1.22—1.39 mm; a = 26—34; b = 3.8—4.0; c = 70—72; V = $^{3.4-4.0}$ 36—39 $^{10-11}$.



Text-fig. 3. *Belondira neortha*. A. Entire female. B. Anterior end. C. Surface view of anterior end. D. Neck region. E. Female gonads. F. Vulva in ventral view. G. Posterior region.

Description: Body nearly straight or curved slightly ventrally upon fixation, tapering rapidly at anterior end while gradually towards posterior end. Cuticle marked with fine striae transversely; its thickness 2-3 μm in mid-body and 5-7 μm at tail tip (thickest). Cuticle forming two pairs of prominent notches in odontostyle region. Lateral chords narrow in middle, 1/17th — 1/12th of body-width near middle. Prominent irregularly spaced lateral glandular organs distinct in posterior fourth of body but these are less distinct in the rest of body; one lateral body pore present at each lateral glandular organ. Lateral body pores 43-52 in number of which 10-13 in oesophageal region, 24-31 in intestine region, 5-7 in prerectum-rectum region, and 2 in tail region. Dorsal and ventral body pores not distinct.

Lip region rounded with amalgamated lips, narrower than body, 1/5.5-1/6.5 of body-width at base of oesophagus. Amphids stirrup-shaped; apertures occupying 4-5 μm or 52-57% of corresponding body-width, 4-5 μm from anterior extremity. Sensillar pouches 19-21 μm from amphidial apertures.

Odontostyle 6-7 μm or 0.8—1.0 lip region-width long, its thickness slightly less than corresponding cuticle-width; aperture about 3 μm or 42-46% of odontostyle length. Guiding ring 5-6 μm or 0.7—0.8 lip region-width from anterior end. Odontophore 12-15 μm or about 1.9—2.2 times the odontostyle length. A typical swelling present in the anterior part of oesophagus a little behind its commencement. Anterior slender part of oesophagus non-muscular while enlarged part with strong musculature like that of *Axonchium*. Basal expanded portion of oesophagus occupying 51-57% of the neck region, enveloped by a sheath of dextral spiral muscle bundles. Locations of all oesophageal gland and their orifices distinct only in two specimens as follows:

DO = 44.5—46.8	S_1N_1 = 69—74	S_2N = 90—91
DN = 46.5—49.6	S_1N_2 = 72—76	S_2O = 91—92
DO—DN = 2.0—2.8		
K = 87—98	K′ = 89—98	

Nerve ring 92-100 μm or 26-29% of neck region from anterior end. Cardia 11-12 μm or 1/4th-1/3rd of corresponding body-width long, tongue-shaped, enveloped by intestinal tissue. Prerectum offset by a constriction from intestine, 92-129 μm or 3.6—5.0 times the anal body-width.

Vulva transverse and oval, situated in a deep depression. Vagina extending inward 17-23 μm or about 1/3-1/2 of the corresponding body-width. Anterior sexual branch rudimentary, 38-58 μm or 1.0—1.4 as long as corresponding body-width. Posterior sexual branch

normal, typical. Uterus and oviduct separated by a sphincter; oöcytes arranged in a single row except at growth region. Sperm not seen.

Tail hemispherical without expansion of outer cuticle, 17-21 μm or 0.7—0.8 anal body-width long, with two caudal pores on each side.

Male : Not found.

Localities and habitats: Matigarh population : From soil around roots of Banana at Matigarh, 6 km from Siliguri on Siliguri-Darjeeling Road, District Darjeeing, West Bengal. Dagapur population: From soil around roots of Tea at Dagapur Tea Estate on Siliguri-Darjeeling Road, District Darjeeling, West Bengal.

Remarks: Siddiqi (1964) described this species on a single female and a male from Kathmandu, Nepal. Now we have got two populations with eleven females. It was, therefore, considered necessary to give a detailed description of females. Unfortunately, males were not available to be included in the present study.

Our specimens fit well with the original description of *B. neortha* except that the body length and anterior rudimentary sexual branch are longer (after Siddiqi, (1964) : L = 1.17 mm; anterior rudimentary sexual branch less than one vulvar body-width long). Siddiqi (l. c.) did not mention the presence of distinct cuticular notches in odontostyle region, the arrangement of spiral muscle bundle at basal expanded part of oesophagus, location of oesophageal gland nuclei and their orifices, and the constriction between intestine-prerectum junction.

This species is reported for the first time from India.

Summary

Variations have been noted in *Thornenema cavalcantii* (Lordello, 1955) Andràssy, 1959 and *Oriverutus sundarus* (Williams, 1964) Siddiqi, 1971 belonging to the family Dorylaimidae. The abnormal development of anterior sexual branch in *Thornenema cavalcantii* has also been reported. *Belondira neortha* Siddiqi, 1964 belonging to the family Belondiridae has been redescribed in detail, since the original description is based on a single female and male. *Oriverutus sundarus* and *Belondira neortha* have been reported for the first time from India.

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Nematodes from West Bengal (India) II,
Nine species of Predaceous Nematodes (Mononchida)

Our knowledge of the distribution of predaceous nematodes belonging to the Order Mononchida is very meagre. This is the second paper of the series on "Nematodes from West Bengal (India)" which deals only with mononchs from the following districts of West Bengal : Cooch Behar, Jalpaiguri and Darjeeling. In all, nine species of the suborder Mononchina belonging to three families and genera have been identified. Apart from these species, a single female of the suborder Bathyodontina, family Mononchulidae, genus *Mononchulus* has also been collected. All these species are new records for the state.

Suborder MONONCHINA Kirjanova & Krall, 1969

Family MONONCHIDAE Chitwood, 1937

1. *Clarkus papillatus* (Bastian, 1865) Jairajpuri, 1970

Females (2) : L=0 93-1.00 mm ; a=24-26 ; b=3.3-3 6 ; c=16-17 ; V=62-63.

Habitat and locality.—Soil around roots of banana from Darjeeling.

2. *Prionchulus muscorum* (Dujardin, 1845) Wu & Hoeppli, 1929

Females (10) : L=1 44-1.86 mm ; a=21-28 ; b=3.4-3 9 ; c=13-18 ; V=65-68.

Habitat and locality.—Soil around roots of banana from Darjeeling.

Family MYLONCHULIDAE Jairajpuri, 1969

3. *Mylonchulus lacustris* (N.A. Cobb in M.V. Cobb, 1915) Andrássy, 1958

Females (3) : L=1.35-1.68 mm ; a=33-38 ; b=3.8-4.1 ; c=26-30 ; V=60-62.

Habitat and locality.—Soil around roots of banana from Shaktigarh, District Jalpaiguri.

4. *Mylonchulus incurvus* (Cobb, 1917) Andrássy, 1958

Females (2) : L=1.14-1.16 mm ; a=25-27 ; b=3.2-3.3 ; c=27-28 ; V=60-61.

Habitat and locality.—Soil around roots of tea from Lebong, District Darjeeling.

5. *Mylonchulus brachyuris* (Bütchli, 1873) Altherr, 1953

Females (3) : L=1.01-1.91 mm ; a=28-31 ; a=28-31 ; b=3.2-35 ; c=26-27 ; V=65-66.

Habitat and locality.—Soil around roots of banana from Darjeeling.

6. *Mylonchulus brevicaudatus* (Cobb. 1917) Altherr, 1954

Female (1) : L=1.28 mm ; a=25 ; b=3.1 ; c=47 ; V=61.

Habitat and locality.—Soil around roots of tea from Lebong, District Darjeeling.

7. *Mylonchulus mulveyi* Jairajpuri, 1970

Females (7) : L=0.91-1.05 mm ; a=23-27 ; b=3.1-3.4 ; c=21-23 ; V=74-77.

Habitat and locality.—Soil around roots of banana from Lebong, District Darjeeling.

Family IOTONCHIDAE Jairajpuri, 1969

8. *Iotonchus trichurus* (Cobb, 1917) Andrássy, 1958

Female (1) : L=1.62 ; a=45 ; b=4.9 ; c=4.5 ; V=66.

Habitat and locality.—Soil around roots of banana from Shaktigarh, District Jalpaiguri.

9. *Hadronchus shakili* Jairajpuri, 1969

Females (3) : L=3.01-3.09 mm ; a=40-45 ; b=4.7-4.8 ; c=5.3-6.1 ; V=56-58.

Males (4) : L=2.66-2.92 mm ; a=45-48 ; b=4.8-5.3 ; c=5.4-7.0 ; T=44-65.

Habitat and locality.—Soil around roots of banana from Dakshingurihati, District Cooch Behar.

Suborder BATHYODONTINA Coomans & Loof, 1970

Family MONONCHULIDAE (De Coninck, 1965) Jairajpuri, 1969

Mononchulus sp.

Female (1) ; L=1.01 mm ; a=25 ; b=4.0 ; c=10 ; V=61.

Habitat and locality.—Soil around roots of paddy from Tufangunj, District Cooch Behar.

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S. Khera

Trematode Fauna of Rajasthan, India Part 3, Trematodes from Frogs

Trematodes from frogs of different parts of India have been studied by various workers. Very little is known about trematodes infecting frogs in Rajasthan. Gupta (S. P.) & Agrawal[1-2] have reported occurrence of *Halipegus udaipurensis*; and *Pleurogenes gastroporus* and *Mehraorchis ranarum* from Udaipur. Gupta, P. D.[3] has recorded *Ganeo kumaonensis, G. tigrinum, Halipegus mehransis, Pleurogenes gastroporus* and *Tremiorchis ranarum* from Western Rajasthan. During the last few years some more material was collected and result of studies on that collection is given here.

Family ACANTHOSTOMIDAE Poche

1. **Acanthostomum sp.**

Material.—1 ex., Ajmer District, 11.x.64.

Distribution.—Rajasthan, Maharashtra & Uttar Pradesh.

Remarks.—This specimen got damaged during mounting. However the two parts show the characters clearly. It resembles very closely *A. indicum* Sinha (1940) but differs from it in size, position of gonads slightly in front of the posterior extremity and shorter

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Nematodes from West Bengal (India) III. Five Ectoparasitic Nematode Species of Longidoridae (Dorylaimida)

This is the third paper of the series on "Nematodes from West Bengal (India)" which deals with the distribution of five ectoparasitic nematode species belonging to the genera *Xiphinema* Cobb 1913 and *Paralongidorus* Siddiqi, Hooper and Khan, 1963 of the family Longidoridae (Thorne, 1935) Meyl, 1961. The species reported hereunder have been collected from Jalpaiguri and Darjeeling districts of West Bengal.

1. Xiphinema radicola Goodey, 1936

Females (4) : L = 1.77-1. 88 mm; a = 39-44; b = 5.3-6.4; c = 34-37; v = 0.4-0.5 25-28 8-9; odontostyle = 90-94 µm; basal portion = 55-64 µm.

Host and locality : Soil around roots of tea from Dagapur Tea Estate, District Darjeeling.

Remark : This species is recorded for the first time from India.

2. Xiphinema brasiliense Lordello, 1951

Females (11) : L = 2.17-2.38 mm; a = 36-43; b = 5.1-5.9; c = 42-53; V = 0-4-0.8 23-25 8-16; odontostyle = 126-133 µm; basal portion = 64-71 µm.

Hosts and localities : (i) Eleven females from soil around roots of tea at Happy Valley Estate. Darjeeling; (ii) four females from soil around roots of banana at Lebong, Darjeeling.

Remark : This species is recorded for the first time from India.

3. Xiphinema insigne Loos, 1949

Females (15) : L = 1.86-2.45 mm; a = 41-52; b = 5.5-6.4; c = 18-27; V = 6-9 28-31 10-16; odontostyle = 92-112 µm; basal portion = 58-67 µm.

Male (1) : L = 2.37 mm; a = 57; b = 6.4; c = 38; T = 48; odontostyle = 92 µm; odontophore = 55 µm.

Hosts and localities : Six females from around roots of tea at Lebong, Darjeeling; (ii) six females from soil around roots of tea at Dagapur Tea Estate, District Darjeeling; (iii) two females from soil around roots of banana at Darjeeling; (iv) five Females and one male from soil around roots of mango at Shaktigarh, District Jaipaiguri.

Remarks : This species is recorded for the first time from State.

4. **Xiphinema riversi** Dalmasso, 1969

Female (1) : L = 2.09 mm; a = 51; b = 5.6 c = 72; V = ^{8} 55^{8}; odontostyle = 106 µm; basal portion = 58 µm.

Host and locality : Soil around roots of banana from Darjeeling.

Remarks : This species is recorded for the first time from India.

5. **Paralongidorus citri** (Siddiqi, 1959), Hooper and Khan, 1963

Females (10) : L = 6.37-8.66 mm; a = 99-152; b = 10.3-15 8; c = 184-238; V = $^{4-5}$ 42-46 $^{4-6}$; odontostyle = 126-141 µm; basal portion = 74-90 µm.

Hosts and locality : Soil around roots of mango and banana from New Jalpaiguri, District Jalpaiguri.

Remark : This species is recorded for the first time from state

Zoological Survey of India,
Calcutta.

A. Jana
Quiser H. Baqri

On a collection of moths (Lepidoptera : Heterocera) from Siang district, Arunachal Pradesh, India

The following account is based on the material collected by Drs. S. K Tandon and G. S. Arora, in the Siang district of Arunachal Pradesh, in the year 1966. It deals with the families Uraniidae, Geometridae, Zygaenidae, Cochlidionidae and Lymantriidae. Fourteen species distributed over thirteen genera are reported, all of which are new records for Arunachal Pradesh.

Nematologica 24 (1978): 436-444. Leiden, E. J. Brill

STUDIES ON MONONCHIDA
XI. TWO NEW SPECIES OF *IOTONCHUS*, *COBBONCHUS INDICUS* N. SP. AND *ANATONCHUS GINGLYMODONTUS* MULVEY, 1961

BY

QAISER H. BAQRI [1]), SAMER Z. BAQRI [2]) and M. SHAMIM JAIRAJPURI [2])

Three new and a known species of Mononchida are described, viz., two of *Iotonchus*, one *Cobbonchus* and *Anatonchus ginglymodontus*. *Iotonchus longicaudatus* n. sp. is closely related to *I. trichurus* and *I. chantaburensis* but has apex of dorsal tooth in anterior half of buccal cavity. *Iotonchus coomansi* n. sp. differs from the closely related *I. antedontus* in having a smaller body and in the posterior position of amphids. *Cobbonchus indicus* n. sp. comes close to *C. ockerti* but differs in characters of lip region and tail. *Anatonchus ginglymodontus* is redescribed with the first record of its male.

In the present work five populations of mononchs were studied. They represent three new species: two of *Iotonchus* (Cobb, 1916) Altherr, 1958; one of *Cobbonchus* Andrássy, 1958; and a known species *Anatonchus ginglymodontus* Mulvey, 1961. The specimens of one of the new species of *Iotonchus*, *I. longicaudatus* and *Cobbonchus indicus* n. sp. were collected in India; *Iotonchus coomansi* n. sp. was collected in The Netherlands and obtained through Professor A. Coomans; and *Anatonchus ginglymodontus*, collected in Poland, was received from Dr. A. Szczygiel.

Iotonchus longicaudatus n. sp.
(Fig. 1)

Dimensions:

Dagapur population (*Type population*): Paratype females (3): L = 1.08-1.32 mm; a = 39-45; b = 3.5-4.2; c = 3.4-4.0; V = 59-61.

Holotype female: L = 1.30 mm; a = 40; b = 4.4; c = 4.1; V = 62.

Reang specimen: Female: L = 1.16 mm; a = 33; b = 4.0; c = 4.1; V = 61.

Description:

Female: Body upon fixation ventrally curved in posterior half, tapering slightly anterior to base of oesophagus but sharply towards posterior end. Cuticle 1-4 μm thick (thickest on tail). Lateral chords 1/4th-1/3rd of body-width near middle of body. Lip region offset, wider than adjoining body, 17-21 μm wide and 8-11 μm high. Amphids small, cup-shaped, their apertures 3-4 μm wide and

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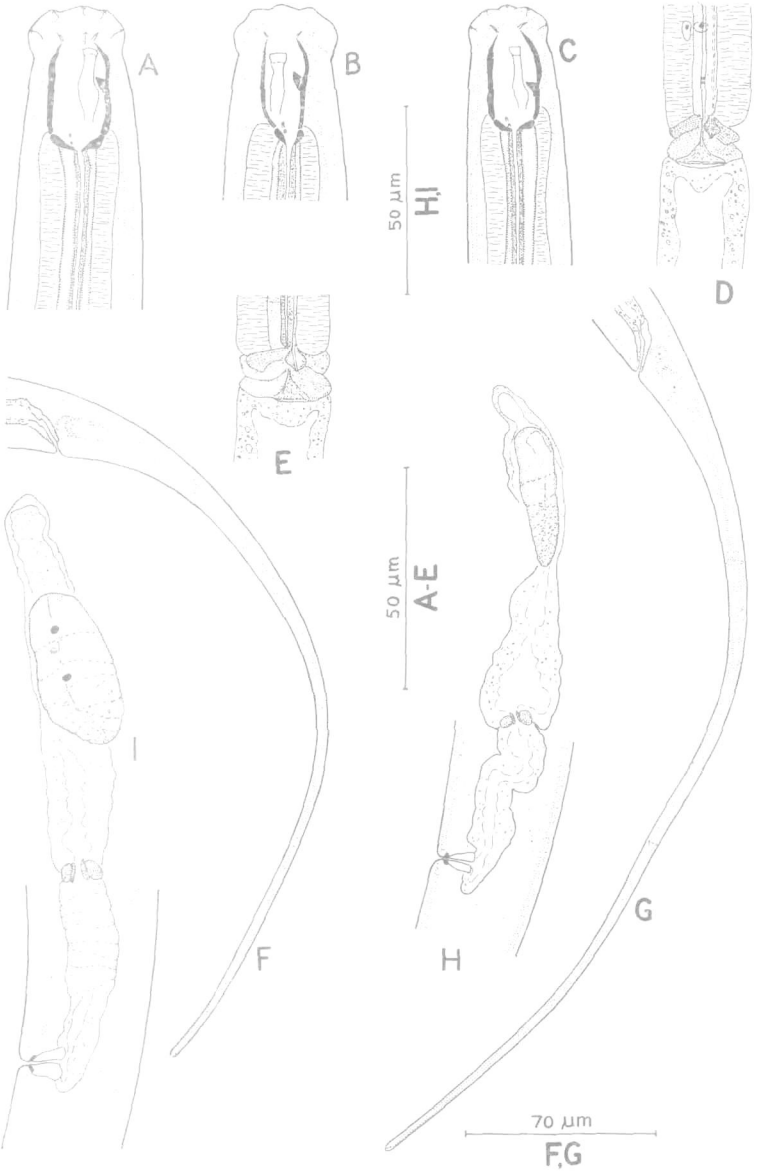

Fig. 1. *Iotonchus longicandatus* n. sp. A-C - Anterior regions, D & E - Oesophago-intestinal regions, F & G - Tails, H & I - Female reproductive system.

8-11 µm from anterior extremity. Sensillar pouches 9-11 µm from amphidial slits. Buccal cavity cylindrical, 21-24 × 12-15 µm. The female from Reang has a narrower buccal cavity (Fig. 1, B). Apex of dorsal tooth 11-17 µm or 1/2-2/3rd from base of stoma. Oesophago-intestinal junction tuberculate. Nerve ring 88-98 µm from anterior end. Rectum 14-18 µm long.

Vulva transverse. Vagina sclerotized distally. Reproductive system mono-prodel-

phic. Uterus and oviduct separated by a sphincter. Ovary reflexed. Sperm not seen. Tail long, filiform, 283-334 μm or fourteen to nineteen anal body-widths long or 24-28% of body length. Caudal glands and subterminal opening present.

Male: Not found.

Type habitat and locality: Soil around roots of tea from Dagapur Tea Estate, about 7 km from Siliguri on Siliguri-Darjeeling Highway, West Bengal, India.

A single female was collected from soil around roots of banana, *Musa paradisiaca* from Reang, Testa, District Darjeeling, West Bengal, India.

Type specimens: Holotype along with paratype females on slide *Iotonchus longicaudatus*/WN 232. Female specimen from Reang on slide *Iotonchus longicaudatus*/WN 233. Type specimens deposited with the National Collection of Zoological Survey of India, Calcutta, India.

Differential diagnosis: *Iotonchus longicaudatus* n. sp. comes close to *I. trichurus* (Cobb, 1917) Andrássy, 1958 and *I. chantaburensis* Buangsuwon & Jensen, 1966. From the former it differs in having apex of dorsal tooth in anterior half of buccal cavity and subterminal opening of caudal glands (apex of dorsal tooth nearly basal and opening of caudal glands terminal in *I. trichurus*). From *I. chantaburensis* it differs in having apex of dorsal tooth in anterior half of buccal cavity and differently shaped tail (apex of dorsal tooth nearly basal and tail ventrally hooked in *I. chantaburensis*).

Iotonchus coomansi n. sp.
(Fig. 2)

Dimensions:

Paratype females (5): L = 0.69-0.80 mm; a = 18-20; b = 3.1-3.4; c = 13-17; V = 56-65.

Holotype female: L = 0.76 mm; a = 19; b = 3.2; c = 17; V = 66.

Description:

Body ventrally arcuate upon fixation, tapering slightly anteriorly but markedly towards posterior end. Cuticle 2-4 μm thick. Lip region offset from body, 18 μm wide, 7-8 μm high. Amphids large, stirrup-shaped; apertures 5 μm wide, 9-11 μm from anterior extremity. Buccal cavity 21-23 × 11-12 μm. Dorsal tooth large in the anterior half of buccal cavity; its apex at 13-14 μm from base of buccal cavity. Nerve ring at 75-85 μm from anterior end of body. Rectum 18-23 μm long.

Vulva transverse. Vagina short; cuticularized pieces present at vulva-vagina junction. Reproductive system amphidelphic. Ovaries consisting of twelve to sixteen oocytes arranged in multiple rows. Uterus and oviduct separated by sphincter. Tail 45-57 μm or 2.0-2.5 anal body-widths long, conoid with rounded terminus, ventrally arcuate. Caudal glands and spinneret absent.

Male: Not found.

Type habitat and locality: Collected at Boxmeer, The Netherlands, habitat not

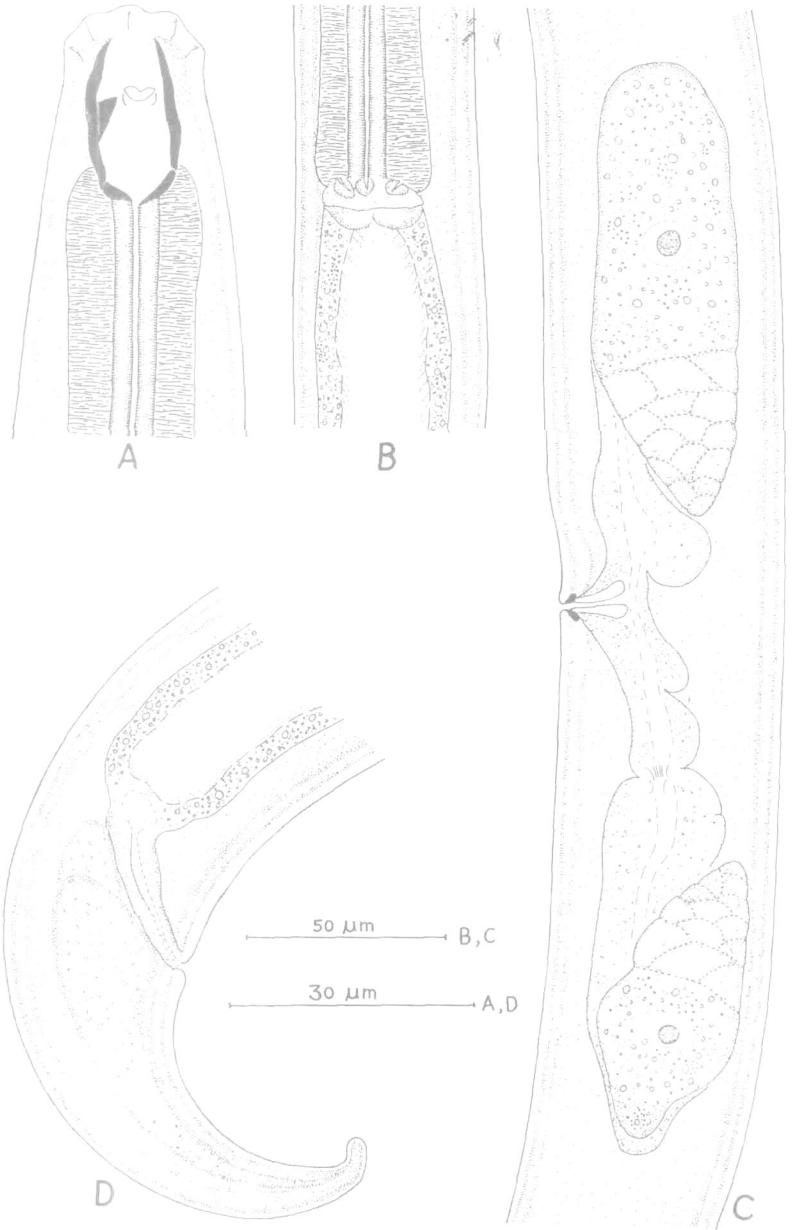

Fig. 2. *Iotonchus coomansi* n. sp. A - Anterior region, B - Oesophago-intestinal region, C - Female reproductive system, D - Posterior region.

known. The specimens were obtained through the courtesy of Prof. A. Coomans.

Type specimens: Holotype on slide *Iotonchus coomansi*/1; paratypes on slide *Iotonchus coomansi*/2.

Differential diagnosis: *Iotonchus coomansi* n. sp. comes close to *Iotonchus antedontus* Mulvey, 1963 but differs from it in having a short body (L = 1.2-1.5 mm

in *I. antedontus*), in the shape and size of buccal cavity (buccal cavity 25-29 × 16-18 μm in *I. antedontus*), larger dorsal tooth, more posteriorly situated and differently shaped amphids, and also in the shape and length of the tail.

Cobbonchus indicus n. sp.
(Fig. 3)

Dimensions:

Holotype female: L = 1.08 mm; a = 37; b = 3.4; c = 49; V = 66.
Paratype male: L = 1.07 mm; a = 45; b = 3.4; c = 43; T = 50.

Description:

Female: Body upon fixation strongly curved ventrally in posterior half, tapering slightly towards extremities. Cuticle 1-2 μm thick. Lateral chords about 1/4th of corresponding body-width near middle. Lip region offset, wider than adjoining body, 16 μm wide, 6 μm high. Amphids cup-shaped; their apertures slit-like, 4 μm

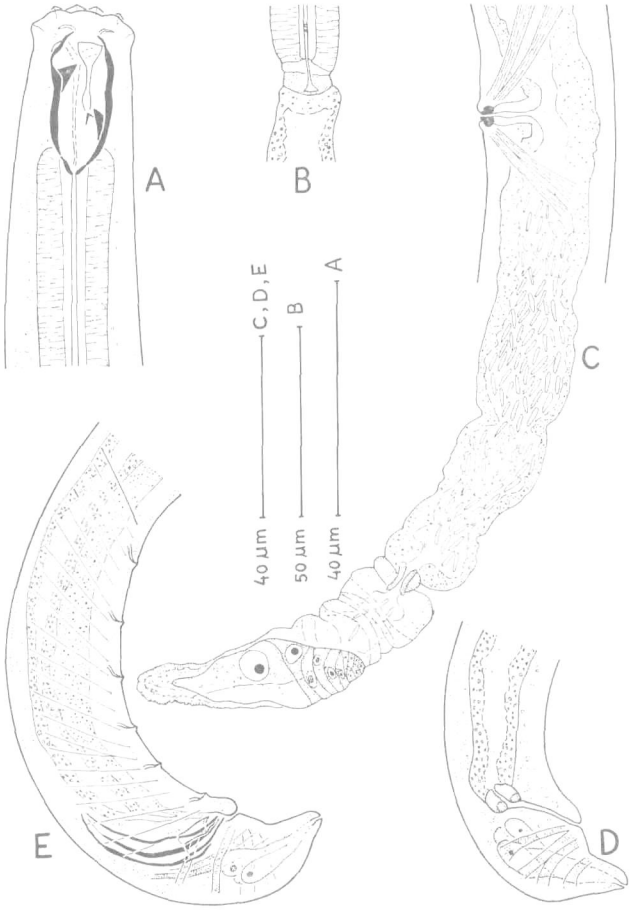

Fig. 3. *Cobbonchus indicus* n. sp. A - Anterior region, B - Oesophago-intestinal junction, C - Posterior reproductive branch of female, D - Tail region of female, E - Posterior region of male.

wide, located near anterior end of buccal cavity. Sensillar pouches 9 μm from amphidial apertures. Buccal cavity 23 × 11 μm, arching inwards anteriorly and somewhat pointed at base. Dorsal tooth apex at 18 μm or 78% from base of stoma; subventral teeth smaller than dorsal, their apices at 10 μm or 43% from base of stoma. Oesophago-intestinal junction non-tuberculate. Nerve ring 87 μm from anterior end. Rectum 14 μm long.

Vulva transverse. Vagina sclerotized distally, extending inwards 12 μm or less than 1/2 of corresponding body-width. Reproductive system amphidelphic, ovaries reflexed. Uteri filled with sperms. Uterus and oviduct separated by a well developed sphincter. Tail short conoid, rather bulbous, slightly ventrally curved, 22 μm or 1.2 anal body-width long. Caudal glands well developed; opening situated slightly dorsally.

Male: Similar to female in general shape and morphology. Buccal cavity 22 × 9 μm. Dorsal tooth apex at 17 μm or 77% from base of stoma; apices of subventral teeth 9 μm or 41% from base of stoma. Testes opposed, outstretched. Spicules 36 μm or 1.6 anal body-width long medially. Gubernaculum 7 μm long and lateral accessory pieces 9 μm long. Supplements six, spaced nearly at regular intervals. Copulatory muscles 20, extending a little anterior to supplement region. Tail similar to female, 26 μm or 1.2 anal body-width long. Caudal glands present; opening situated slightly dorsal.

Type habitat and locality: Soil around roots of tea from Dodabetter, Ooty, Nilgiri, India.

Type specimens: Collected in October, 1972; holotype female along with paratype male on slide *Cobbonchus indicus*/WN 231; deposited with National Collection of Zoological Survey of India, Calcutta.

Differential diagnosis: *Cobbonchus indicus* n. sp. comes close to *C. mauritianus* (Williams, 1958) Clark, 1960 and *C. ockerti* Coetzee, 1965. From *C. mauritianus* it differs in having more offset and differently shaped lip region; in the size of the buccal cavity; shorter and differently shaped tail; and in the absence of ampulla near the opening of caudal glands (buccal cavity 32 × 18 μm; c = 24; and ampulla prominent before subdorsal opening of caudal glands in *C. mauritianus*). From *C. ockerti* it differs in having more offset lip region; more anteriorly situated amphids; in the location of caudal glands; in the number and spacing of supplements; and in having differently shaped spicules and gubernaculum (amphids situated at level of dorsal tooth apex; caudal glands extending beyond anus; and fourteen supplements in *C. ockerti*).

Anatonchus ginglymodontus Mulvey, 1961
(Fig. 4)

Dimensions:

Females (5): L = 2.63-2.91 mm; a = 30-34; b = 4.4-4.7; c = 8.1-10.4; V = 60-64.

Male: L = 2.75 mm; a = 34; b = 5.1; c = 14; T = 35.

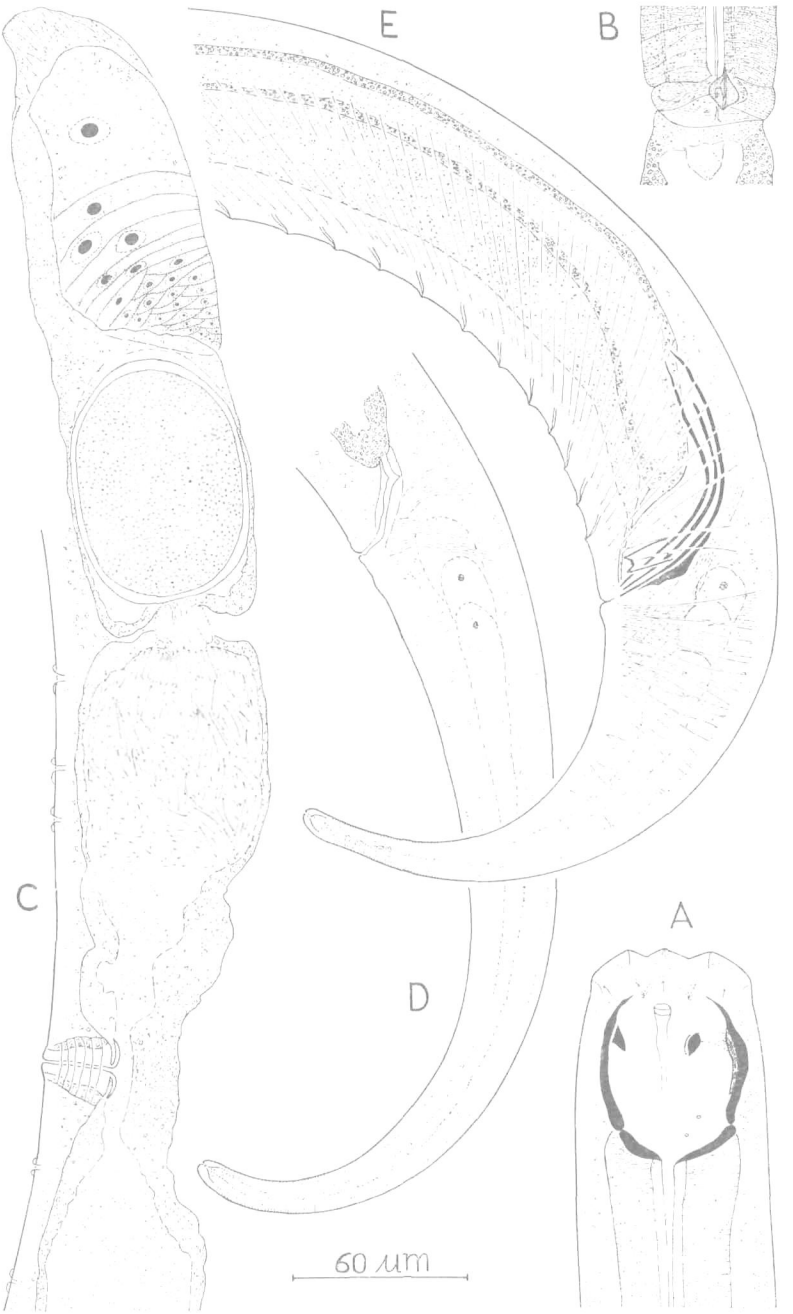

Fig. 4. *Anatonchus ginglymodontus* Mulvey, 1961 A - Anterior region, B - Oesophago-intestinal junction, C - Anterior reproductive branch of female, D - Tail region of female, E - Posterior region of male.

Description:

Female: Body ventrally arcuate upon fixation, tapering slightly anterior to base of oesophagus but markedly posteriorly. Cuticle 2-4 μm thick, transversely striated, striations more prominent on tail. Lateral chords about 1/3rd of body-width near middle. Lip region slightly offset from body, slightly wider than adjoining body, 46-55 μm wide and 18-20 μm high. Amphids funnel-shaped; apertures 7-8 μm wide. Sensillar pouches 10-13 μm from amphidial slits. Buccal cavity 53-63 × 40-51 μm; walls of buccal cavity anterior to base of teeth weakly developed. Three medium-sized teeth hinged to anterior wall of buccal cavity, 38-45 μm or 67-71% from base of stoma. Oesophago-intestinal junction tuberculate. Nerve ring 184-197 μm from anterior end. Rectum 33-42 μm long.

Vulva a transverse slit. Pre-vulval papillae zero to four, post-vulval two to six, spaced irregularly. Vagina not sclerotized distally, extending inwards 18-21 μm or about 1/5th-1/4th of the corresponding body-width, surrounded by sphincter. Reproductive system amphidelphic. Sometimes the uteri filled with sperms that are 12-17 μm long. Eggs 84-91 × 61-67 μm. Uterus and oviduct separated by a well developed sphincter. Ovaries reflexed, with numerous oocytes. Tail elongate-conoid, ventrally arcuate, 243-307 μm or 4.6-5.4 anal body-widths long. Caudal glands three, leading to a terminal duct.

Male: Similar to female in general morphology and body shape, except more curved in posterior third of body. Buccal cavity 50 × 40 μm. Testes paired, opposed, outstretched. Spicules 110 μm or 1.7 anal body-width long medially. Gubernaculum 35 μm long and lateral accessory pieces 17 μm long. Supplements twelve in number, spaced nearly at regular intervals. Copulatory muscles 43 in number, occupying the supplement region. Tail similar to female, 190 μm or about three anal body-widths long. Caudal glands three, leading through a terminal duct.

Habitat and locality: Specimens collected from cultivated fields in Poland (exact habitat and locality not known) and obtained through the courtesy of Dr. A. Szczygiel.

Remarks: The present specimens fit well with the description of *A. ginglymodontus* Mulvey, 1961, except for the size of the buccal cavity, in having non-tessellated intestine, in the absence of sclerotization at vulva-vagina junction, in the presence of vulval papillae, and a less thicker tail tip (buccal cavity 42-48 × 40-42 μm, intestine tessellated, sclerotization at vulva-vagina junction present, and vulval papillae absent in *A. ginglymodontus* according to Mulvey, 1961). Mulvey (*in litt.*) informs that re-examination of his specimens of *A. ginglymodontus* revealed the presence of vulval papillae. The other differences are of minor taxonomic value and are considered as variations. Another species, *Anatonchus killicki* Clark, 1963 falls well within the range of *A. ginglymodontus* and may well be its synonym. The present description provides the first record of male of *A. ginglymodontus*.

We are thankful to Dr. T. N. Ananthkrishnan, Director, Zoological survey of

India, Calcutta, and to Prof. S. Mashhood Alam, Head of the Department of Zoology, Aligarh Muslim University for providing research facilities.

RÉSUMÉ

Etudes sur les Mononchida. XI. Deux nouvelles espèces de Iotonchus, Cobbonchus indicus *n. sp. et* Anatonchus ginglymodontus *Mulvey, 1961.*

Trois nouvelles espèces de Mononchida sont décrites et une espèce déjà connue redécrite. *Iotonchus longicaudatus* n. sp. est très proche de *I. trichurus* dont il diffère par l'apex de la dent dorsale situé dans la moitié antérieure de la cavité buccale. *Iotonchus coomansi* n. sp. diffère de l'espèce la plus voisine, *I. antedotus*, par un corps plus court et la position postérieure des phasmides. *Cobbonchus indicus* n. sp. se rapproche de *C. ockerti*, mais les caractères de la région labiale et de la queue sont différents. *Anatonchus ginglymodontus* est redécrit et le mâle signalé pour la première fois.

REFERENCE

MULVEY, R. H. (1961). The Mononchidae: A family of predaceous nematodes II. Genus *Anatonchus* (Enoplida: Mononchidae). *Can. J. Zool.* **39**, 807-826.

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A Taxonomic Revision of the Nematode Species described by S. Stekhoven and Teunissen (1938) from National Virunga Park, Zaïre Republic III. Belondiridae

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ABSTRACT

Schuurmans Stekhoven and Teunissen (1938) described two species belonging to the Belondiridae: *Dorylaimellus heterurus* and *D. multipapillatus*. Both were still present in the original material and are redescribed below: *Dorylaimellus heterurus* appeared to be a *Roqueus* species and is transferred to that genus. The original description of *Dorylaimellus multipapillatus* was based on one male and seven juveniles, but apart from the male specimen, two complete females were present. The original descriptions of both species contain a number of mistakes and are unreliable.

INTRODUCTION

This is the third paper dealing with a revision of the taxonomic work published by S. Stekhoven and Teunissen (1938). For material and methods the reader should refer to the first paper of the series (Baqri and Coomans, 1973).

As in the papers by Nair and Coomans (1973-1975) the belondirids are here considered a family under Dorylaimoidea.

The type specimens of *Dorylaimellus heterurus* were identified as belonging to the genus *Roqueus*. They were compared with type specimens of *R. gracilis* Thorne, 1964 and with topotypes of *R. africanus*

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Andrássy, 1970. The latter species was found to be conspecific with *R. heterurus* (S. Stekhoven and Teunissen, 1938) comb. n. and hence becomes a junior synonym of it. The well preserved specimens from Ivory Coast allowed some detailed observations on the specialized muscles of œsophagus, vulva region and posterior body region of the male.

Dorylaimellus multipapillatus is redescribed on the basis of the type specimens only. However, in the original description only the male adult was reported, while at least 3 specimens, originally considered to be juveniles, are females.

The type specimens of both species except one paralectotype of each species are deposited at the Museum voor Midden-Afrika, Tervuren, Belgium. One paralectotype of each species deposited in the collection of the Instituut voor Dierkunde, Rijksuniversiteit Gent, Belgium.

DESCRIPTIONS

Roqueus heterurus (S. Stekhoven and Teunissen, 1938) comb. n. (Figs. 1 - 3)

syn. *Dorylaimellus heterurus* S. Stekhoven and Teunissen, 1938
Roqueus africanus Andrássy, 1970

Measurements:

The female tail tip breaks off easily, in which case L, a, b, c and V values cannot be given accurately. This is the case for the females from the type series and for two, out of four females from Ivory Coast. When only a short portion is missing, the approximate tail length can be calculated by comparison with the complete specimens, but when larger portions are broken off, this is too inaccurate. In these cases L' or the body length up to the anus has been measured. For this reason and also because males are usually numerous, the male from the type series has been choosen as lectotype.

Lectotype ♂ (MRAC 36587): L: 4.47 mm, W = 55 μm; a = 81.5; b = 11.7; C = 124; T = 66; spicules: 62 μm; lateral guiding pieces: 12 μm.

Paralectotype ♀ ♀ (n = 3) (MRAC 36588, 36589, 36590): L = 5.57 mm (n = 1); L' = 5,03-5,27 mm; W = 60-82 μm; a = 68 (n = 1); b = 13.9 (n = 1); c = 11.3 (n = 1); V = 37.4 (n = 1).

Ivory Coast population :

15 ♂♂ : L = 4.67-5.72 (X = 5.24) mm ; W = 51.5-67.5 (60.0) µm ; a = 78.5-95.5 (87.5) ; b = 12.8-15.6 (14.5) ; c = 115-160 (134.5) ; T = 62.0-75.0 (68.3) ; spicules : 50-63 (56) µm (measured along the curved median line) ; lateral guiding pieces : 11-13 (11.6) µm.

4 ♀♀ : L = 5.50-6.08 (5.80) mm ; L' = 5.06-5.60 (5.34) mm ; W = 67-73 µm ; a = 82.5-91 ; b = 13.2-16.6 ; c = 11.5-13.5 ; V = 35.0-37.5.

Description

Males : Body ventrally arcuate, especially in the posterior region ; tapering towards the anterior end (Fig. 2 G and H). Cuticle finely striated transversely (Fig. 1 C and 2 A). 1.0-2.0 (1.4) µm thick in middle of body and up to 3.0-4.0 (3.4) µm on tail. Lateral chord 13-18 (16.5) µm wide in middle of body, i.e. ⅓-¼ of the corresponding body width. Body pores faint, sparely distributed throughout the body ; in the œsophageal region there are 7-9 lateral, 1-2 dorsal and 5 ventral body pores.

Lip region slightly offset by a shallow constriction (Fig. 1 B-C) ; 10.5-12 µm wide, i.e. 2.1-3.3 (2.5) times as wide as high. Amphids 7.5-8.5 µm (n = 4) wide or about ¾ of the lip region width ; sensillae 21-26 (23, n = 7) µm behind the amphidial aperture (Fig. 1 C). Odontostyle 4.5-6.0 (5.1) µm long ; somewhat irregular in outline ; aperture occupying about one third of the length. Odontophore 14.0-15.5 (14.6) µm long ; with weakly sclerotized anterior part. The whole spear occupies 19.0-20.5 (19.7) µm. Guide ring 5.0-7.0 µm from anterior end (Fig. 1 B).

Œsophagus 340-392 (362) µm long ; with slender anterior portion occupying 211-243 (226) µm and expanded posterior part occupying 122-149 (136) µm or 34-40 (37.5) % of the total œsophageal length (Fig. 1 D). The slender part is encircled by the nerve ring at 149-173 (162) µm from the anterior end ; i.e. at 43-47 (45) % of the œsophageal length (Fig. 1 D). The expanded part is surrounded by a sinistrally twisted spiral sheath with strong and prominently thick muscles (Fig. 1 A, D, E). These muscles appear to be circomyarian and start as two bands (numbers 1 and 2, Fig. 1 F) that are soon joined by another set of three muscle bands (numbers 3-5 in Fig. 1 G, H). Further backward the first two bands end ; they are replaced by three new bands (numbers 6-8 in Fig. 1 I-N). About halfway the bulb, another muscle band appears (number 9 in Fig. 1 L-N) soon followed by two other new bands (numbers 10 and 11 in Fig. 1 N) ; the latter divide

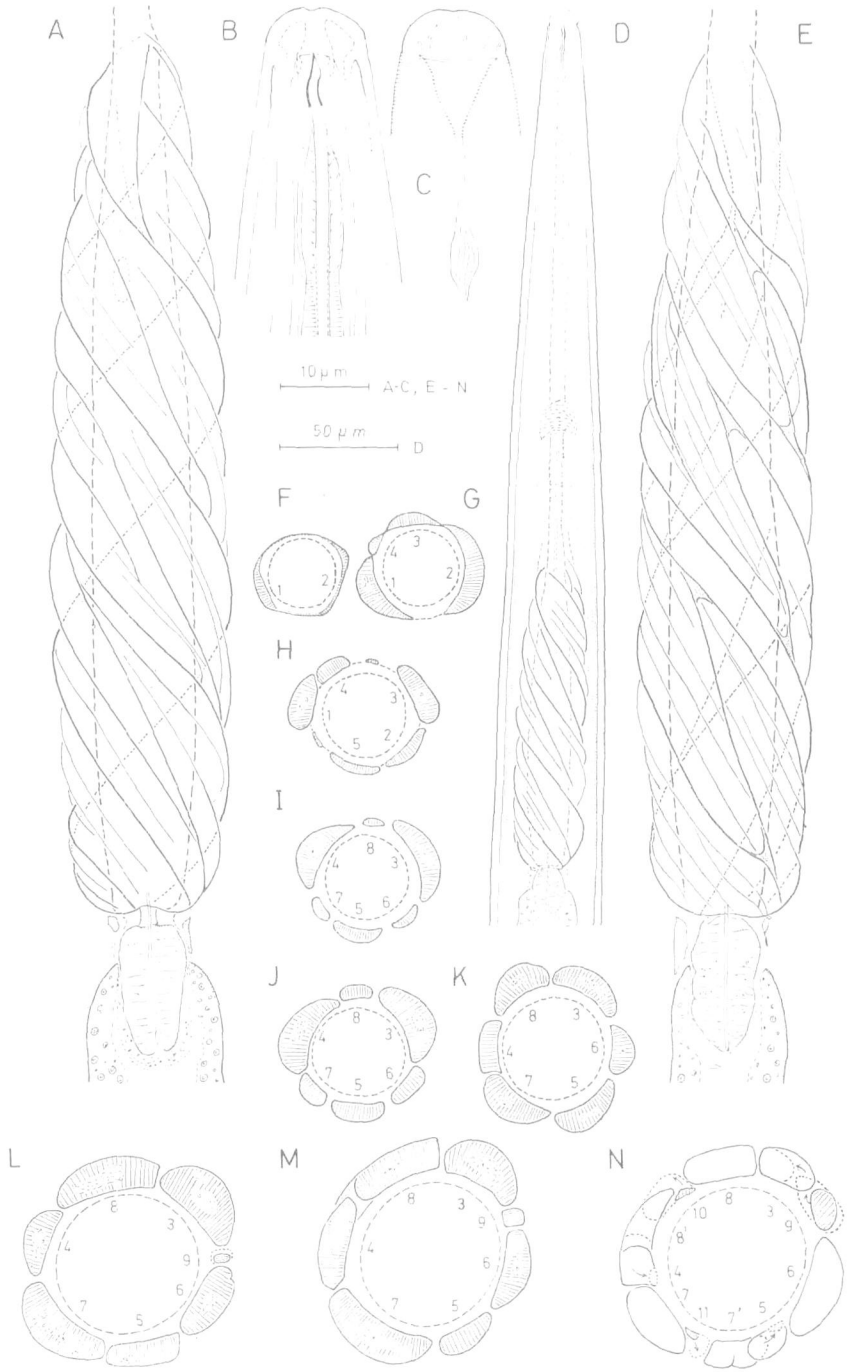

Fig. 1. — *R. heterurus*. A: Spiral sheath and œsophago-intestinal junction in dorsal view; - B: Head end; - C: Head end in surface view showing cephalic sense organs; - D: Œsophageal region; - E: Spiral sheath and œsophago-intestinal junction in subventral view; - F-N: Subsequent cross sections through the anterior half of the spiral sheath (K: at the level of the dorsal gland nucleus).

muscles 8 and 7 into two parts (8, 8' and 7, 7') respectively. Together with the appearance of muscles 9-11, the muscles 3-5 disappear (Fig. 1 N). Dorsal œsophageal gland outlet 32-41 (37, n = 8) μm from the beginning of the bulb; dorsal gland nucleus 3.5-6 μm anterior to the outlet (measured from the centre of the nucleolus); oval to round in shape. Cardia well developed, 13-20 μm long and 10-12 μm wide. Intestinal cells filled with small granules and provided with long microvilli especially in the anterior part. Prerectum 683-860 (761.5) μm long, i.e. 21.6-23.7 (22.7) anal body widths.

Hemizonid well developed, semi-circular, situated opposite or just anterior to the nerve ring.

Male reproductive system consisting of two testes and a long vas deferens, surrounded by a prominent sheath of oblique muscles. Both testes situated at the same side of the intestine, either right or left. Anterior testis 532-902 (702) μm; posterior one 550-972 (729) μm long. The oval sperm cells present in the testes range from 5.5 to 8 (6.4) μm in length. Spicules with simple median piece. Lateral guiding pieces rodlike, with narrower distal and wider proximal part; distal end obscurely bifid. In addition to the adanal pair, an almost contiguous series of 9-14 ventromedian supplements present. In this region 7-10 subventral papillae occur at both sides of the body. There are 69-84 (76) copulatory muscles at both sides in the posterior region, the last four of these muscles are the longest and they extend about halfway into the tail (Fig. 2 B, J). More transversely orientated accessory copulatory muscles are present in the cloacal- and tail region; the anterior ones are completely and the more posterior ones are partly covered by the posteriormost copulatory muscles (Fig 2 B, J). Anterior and posterior protractor muscles as well as retractor muscles guide spicule movement (Fig. 2 E, I). The posterior protractor muscles consist of two sets: (1) an internal pair (Fig. 2 E, i.p.pr.sp.) that runs along the dorsal and inner side of the spicules, passes in between the anal depressor and attaches to the ventral wall of the tail; (2) an external pair (Fig. 2 I, e.p.pr.sp.) that runs along the lateral and external side of the (retracted) spicules and attaches to the terminal and dorsal wall of the tail. The cloacal opening is guarded by two muscles: (1) a transversely orientated anal dilator (Fig. 2 E, an.dil.) at both sides of the tail; (2) a longitudinally orientated anal depressor (Fig. 2 I, an. depr.) that surrounds the posterior parts of the internal posterior spicule protractors and is itself flanked respectively by the

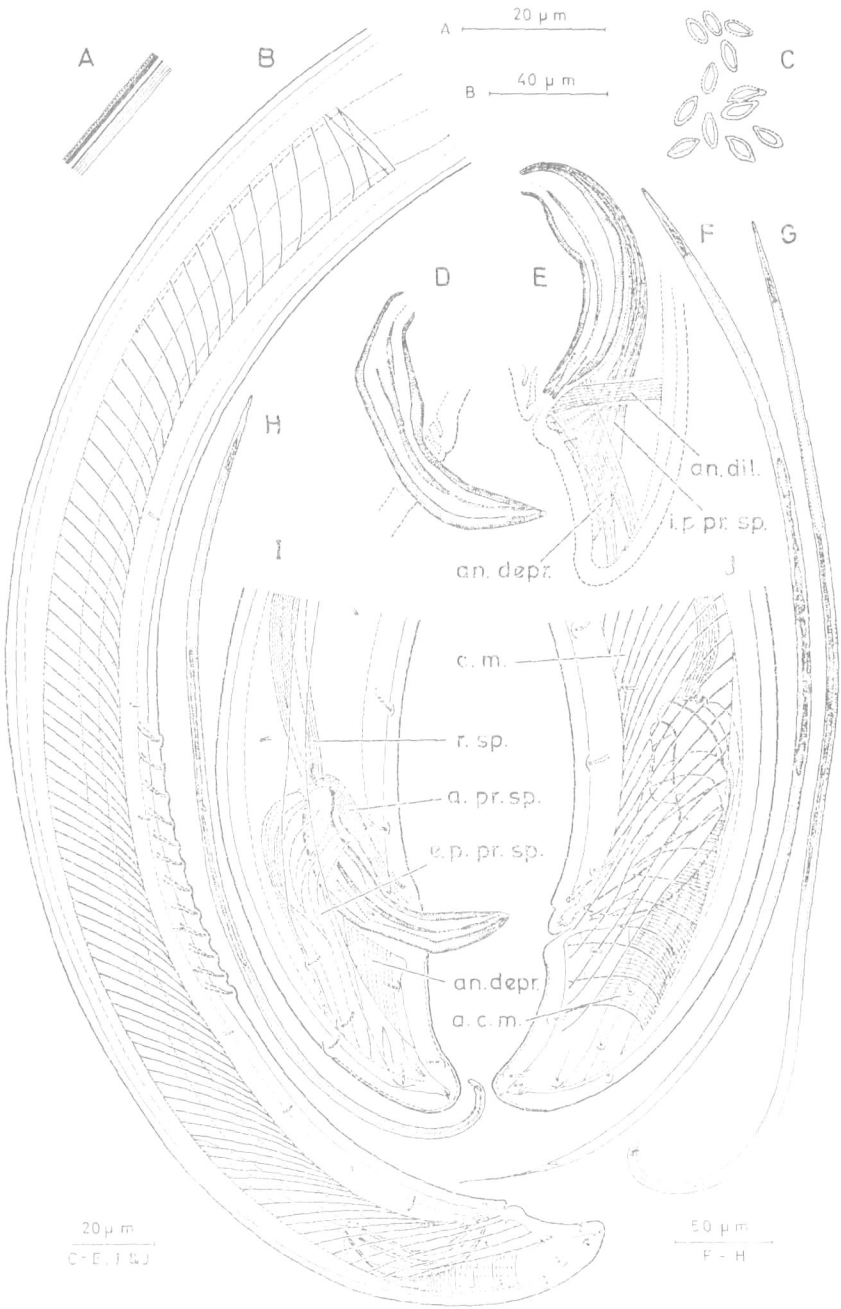

Fig. 2. — *R. heterurus*. A: Body wall structure; - B: Posterior region of male; - C: Sperm cells; - D: Protruded spicule; - E: Tail region with retracted spicule, lateral guiding piece, internal posterior spicule protractor (i. p. pr. sp.), anal dilator (an. dil.) and anal depressor (an. depr.); - F: Entire female; - G-H: Entire male; - I-J: Tail region of male showing various specialized muscles: copulatory muscles (c. m.), spicule retractor (r. sp.), anterior (a. pr. sp.) and external posterior (e. p. pr. sp.) spicule protractors, anal depressor (an. depr.) and accessory copulatory muscles (a. c. m.).

anal dilators, accessory copulatory muscles, copulatory muscles and somatic muscles in its anterior part and by the external posterior spicule protractors in its posterior part.

Tail dorsally convex-, ventrally slightly concave-conoid, with rounded terminus; 33-45 (39.4) μm long, i.e. 0.95-1.3 (1.16) anal body widths long. On each side there are 6-9 caudal pores and one additional sublateral one that may be adanal, slightly preanal or just postanal.

Females: Agreeing with the males in general morphology, except for the following: Body regularly tapering towards both extremities, more posteriorly so than anteriorly. Body cuticle slightly thicker (2-3 μm); tail cuticle thickest about 1-2 anal body widths behind anus. Spear 20-22 μm long, 5-6 μm occupied by the odontostyle and 15-16.5 μm by the odontophore. Œsophagus 342-415 μm long, with slender part 215-263 μm and expanded part 124-152 μm long. Cardia 15-24 μm long, 10-15 μm wide. Prerectum 573-799 μm or 18.5-26 anal body widths long (n = 2). Rectum 27-46 μm long or 0.86-1.27 times the anal body width.

Nerve ring at 142-172 μm from the anterior end.

Female reproductive system didelphic, amphidelphic. The anterior branch is 530-756 μm long or 11.1-12.5 % of the body length; the posterior branch is 562-1008 μm long or 11.2-17.9 % of the body length. Each branch consisting of a long rather uniform uterus with spermatozoa, separated by a sphincter from an about equally long oviduct and a reflexed ovary (Fig. 3 A, B). Both uteri join the vagina, that extends about halfway into the body (Fig. 3 C, F). Vulva transversely oval. Two sets of dilator muscles, vulval and vaginal ones occur in this area (Fig. 3 C); the former extend from the vulva cuticle to the body wall where they attach in between the somatic muscles and the ventral side of the lateral chord; the latter extend from the proximal part of the vagina to the body wall in between the dorsal side of the lateral chord and the somatic muscles. Furthermore the vagina is surrounded by a well developed sphincter with six muscle bands (Fig. 3 C, E). In the region of the vulva there are two subventral rows of cuticular differentiations. In the females studied, 4-8 of these are anterior to and 3-9 posterior to the vulva (Fig. 2 C, F).

Tail long and filiform, 437-509 μm or 14.5-16.1 anal body widths long; terminal non-protoplasmic portion 77-92 μm (n = 2) long. Two caudal pores present at either side, one dorsolateral and one ventrolateral, in the area between one and two anal body-widths behind the anus (Fig. 3 D).

Fig. 3. — *R. heterurus*. A-B: Anterior branch of the female reproductive system; - C: Vulva region showing cuticular differentiations and specialized muscles; - D: Female tail; - E: Vulva and vagina in longitudinal section; - F: Vulva region of another female.

Type localities and habitat: Kanyabayongo, on top of the Kabasha slope, alt. 1760 m, Zaïre and Sesero mountain, N. of the Mikeno volcano, bamboo and mixed forest, alt. 2,000 m; Zaïre.

Other localities: Soil around *Oryza sativa* in Adiopodoumé, Mbengue and Baoulé region, all Ivory Coast. Also found in South Africa by Andrássy (1970 b).

Dorylaimellus multipapillatus S. Stekhoven and Teunissen, 1938
(Fig. 4)

Measurements:

Lectotype ♂ (MRAC 36580): L = 1.86 mm; W = 34 μm, a = 55; b = 8.8; c = 35; T = 57; spicules: 39 μm; lateral guiding pieces: 10.5 μm.

Paralectotype ♀ ♀ (n = 2) (MRAC 36581, 36582): L = 2.09-2.48; W = 35-43.5 μm; a = 57-60; b = 8.9-10.2; c = 36-45; V = 49.5-50.

Description

Male: Body irregularly curved, with strong curvation in tail region; tapering towards the extremities. Cuticle 1.5 μm throughout the body and 6.5 μm at the tail tip; with fine transverse striations. Lateral chord about ⅓ of the corresponding body width near mid-body.

Lip region offset by a constriction, almost 8 μm wide and 3 μm high. Spear 19.5 μm long, 7 μm of which occupied by the odontostyle and 12.5 μm by the odontophore. Guide ring obscure, about one lip region width from anterior end.

Œsophagus 212 μm long, with 128 μm long slender anterior part and 84 μm long expanded posterior part. The latter covered by a sheath of slightly dextrally spiraled muscle bands (cf. Fig. 4 C). Cardia semicircular, about 10 μm wide and long.

Male reproductive system typical. Elliptical sperm cells 6-7 μm long. Spicules curved at right angles; lateral guiding pieces simple. In addition to the adanal pair, 6 medioventral supplements present (Fig. 4 F). There are 21 copulatory muscles, followed by a number of accessory copulatory muscles.

Tail dorsally convex-conoid, with subdigitate end; 53 μm or about two anal body widths long; with three caudal pores (Fig. 4 F).

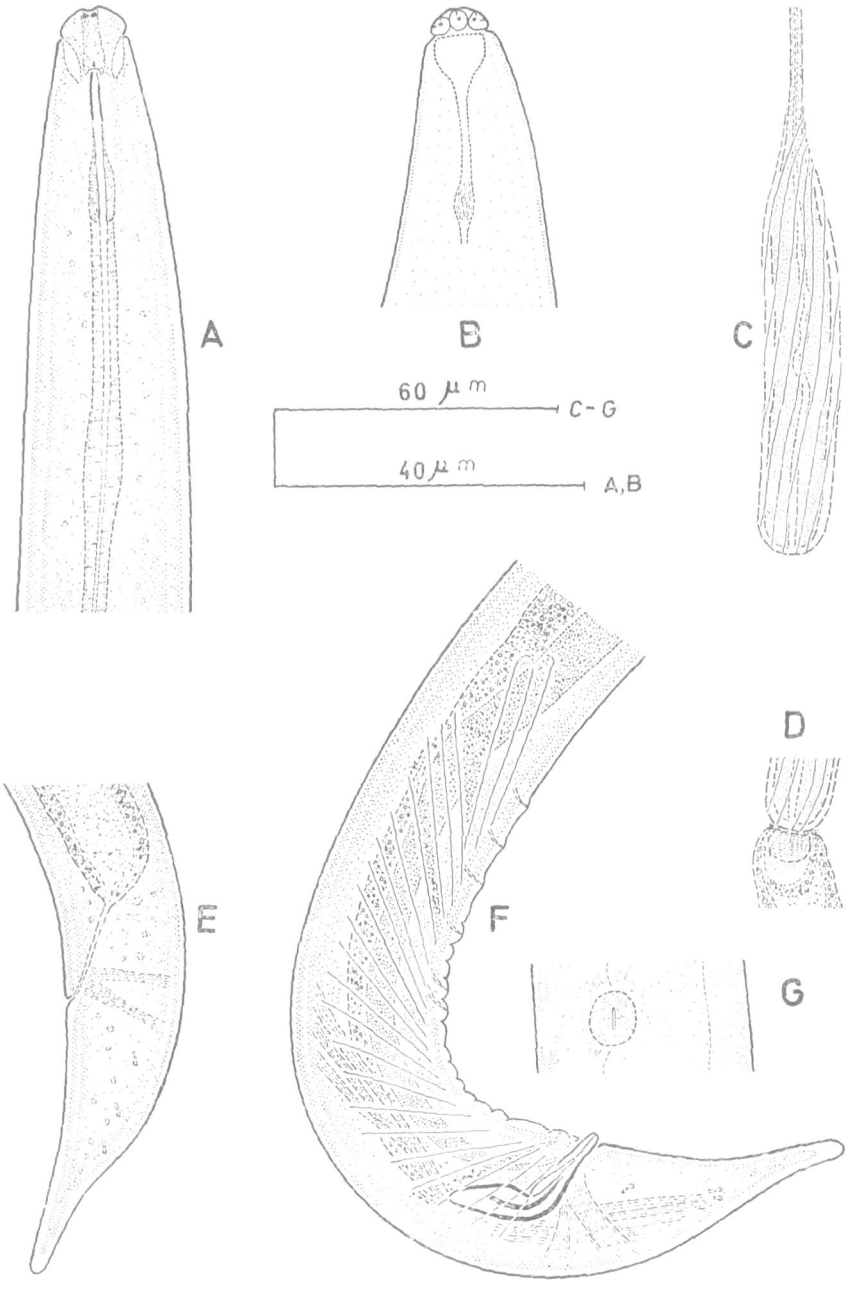

Fig. 4. — *Dorylaimellus multipapillatus*. A: Anterior end; - B: Anterior end in surface view; - C: Expanded part of œsophagus; - D: Œsophago-intestinal junction; - E: Female tail; - F: Male tail; - G: Vulva in ventral view.

Females : Corresponding with male in gross morphology. Amphids wide pockets; with slit-like apertures almost as wide as corresponding head width and with sensillae about opposite the end of the odontophore (Fig. 4 B). Lip region 8 μm wide and 3.5 μm high. Odontostyle 7.5 μm, odontophore 11.5-12 μm long. Guide ring 7-8 μm from anterior end.

Œsophagus 234-243 μm long, with slender anterior part 144-160 μm and expanded posterior part 82-90 μm long. Cardia 8-10 μm wide and long (Fig. 4 D).

Female reproductive system didelphic, amphidelphic. Vulva a 4 μm long longitudinal slit (Fig. 4 G).

Tail 55-58 μm or 1.9-2.4 anal body widths long; three caudal pores observed on one tail.

Type locality and habitat: Kabara, Mikeno-Karisimbi mountain, *Hagenia-Hypericum* woodland; alt. 3,200 m.

Remarks: This species is close to *D. andrassyi* Heyns, 1974 from which it can be distinguished by its longer body, subdigitate tail and six supplements instead of five.

Due to the flattening of the specimens a number of structural details are no longer visible, hence the description given above is incomplete. It was nevertheless possible to correct errors present in the original description.

RESUME

Schuurmans Stekhoven et Teunissen (1938) ont décrit deux espèces appartenant à la famille des Belondiridae: *Dorylaimellus heterurus* et *D. multipapillatus*. Ces espèces sont décrites à nouveau comme *Roqueus heterurus* et *D. multipapillatus*. La première espèce est décrite en détail et comparée avec *R. africanus* Andrássy, 1970. Les deux espèces sont identiques et considérées comme synonymes. Le matériel original de *D. multipapillatus* comprenait plusieurs femelles qui avaient été considérées comme juvéniles auparavant.

ACKNOWLEDGEMENT

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NEMATODES FROM WEST BENGAL (INDIA) VI. SPECIES OF CRICONEMATOIDEA (TYLENCHIDA)

BY

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Nothocriconema degrissei n. sp. and *Gracilacus janai* n. sp. are described from West Bengal. *Hemicriconemoides cocophillus* (Loos, 1949) Chitwood & Birchfield, 1957 ; *Hemicriconemoides mangiferae* Siddiqi, 1961 ; *Macroposthonia ornata* (Raski, 1958) de Grisse & Loof, 1965 ; *Macroposthonia onoensis* (Luc, 1959) de Grisse & Loof, 1965 ; and *Paratylenchus dianthus* Jenkins & Taylor, 1956 are also being reported. Besides, *Criconemoides brevistylus* Singh & Khera, 1976 in transferred to the genus *Macroposthonia* de Man, 1880.

A new species of *Nothocriconema* de Grisse & Loof, 1965 collected from soil around roots of tea at Darjeeling and named *N. degrissei* is described. Another new speies of *Gracilacus* Raski, 1962, G. Janai n. sp., from paddy at Saldah is described. The following known species were also found to occur in West Bengal : *Hemicriconemoides cocophillus* (Loos, 1949) Chitwood & Birchfield, 1957 ; *Hemicriconemoides mangiferae* Siddiqi, 1961 ; *Macroposthonia ornata* (Raski, 1958) de Grisse & Loof, 1965 ; *Macroposthonia onoensis* (Luc, 1959) de Grisse & Loof, 1965 ; and *Paratylenchus dianthus* Jenkins & Taylor, 1956.

Criconemoides brevistylus Singh & Khera, 1976 from West Bengal is transferred to *Macroposthonia* de Man, 1880 because of the presence of four well developed and separated submedian lobes on the lip region and an open vulva as evidenced by the examination of the type material.

The type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

HEMICRICONEMOIDES COCOPHILLUS (Loos, 1949) Chitwood & Birchfield, 1957

10 ♀♀ : L=0.42–0.54 mm ; a=13–18 ; b=4.9–5.1 ; c= ? ; V=90–94 ; R=109–120 ; R St=14–15 ; RV=8–12 ; Stylet=50–54 µm.

Habitat and locality : Soil around roots of tea at Dagapur Tea Estate, 10 Km from Siliguri on Siliguri-Darjeeling Road, West Bengal.

HEMICRICONEMOIDES MANGIFERAE Siddiqi, 1961

10 ♀♀ : L=0.47–0.58 mm ; a=14–18 ; b=4.1–5.3 ; c= ? V=91–95 ; R=126–145 ; R St=20–22 ; RV=11–16 ; Stylet=68–75 µm.

Habitats and localities : (i) Soil around roots of pine apple at Chakchaka, district Coochbehar ; (ii) soil around roots of mango at Phul Bari, district Coochbehar ; (iii) soil around roots of banana and mango at Dakshigurihati, district Coochbehar ; (iv) soil around roots of unidentified grasses at Zoological Garden, Darjeeling, West Bengal.

MACROPOSTHONIA ORNATA (Raski, 1958) de Grisse & Loof, 1965

10 ♀♀ : L=0.42–0.51 mm ; a=10–14 ; b=3.5–4.3 ; c= ? ; V=91–95 ; R=79–91 ; R St=12–14 ; RV=5–7 ; Stylet=51–54 µm.

Habitat and locality : Soil around roots of mango at Shaktigarh, district Jalpaiguri, West Bengal.

MACROPOSTHONIA ONOENSIS (Luc, 1959) de Grisse & Loof, 1965

Females 10 : L=0.38–0.44 mm ; a=10–15 ; b=3.6–4.2 ; c= ? ; V=91–95 ; R=124–139 ; R St=15–18 ; RV=7–10 ; Stylet=48–52 µm.

Habitats and localities : (i) Soil around roots of tea at Sukna Railway Station, district Darjeeling ; (ii) soil around roots of paddy at Saldah, district Burdwan, West Bengal.

NOTHOCRICONEMA DEGRISSEI N. SP.

(Fig. 1, A-F)

2 ♀♀ (paratypes) : L=0.36–0.45 mm ; a=11 : b=3.5–4.3 ; c= ? V=$^{36-40}$37–90.

Female : (Holotype) : L=0.39 mm ; a=12 ; b=4.1 ; c= ? V=^{38}89

Female : Body slightly curved ventrally upon fixation. Lip region low, with six rounded lips. First labial annule not very prominent, narrower than second and third annules, pointed slightly forwardly, 10–12 µm wide. The second labial annule 14–18 µm and third annule 18–22 µm wide. First body annule smaller than other annules. Body annules 60–68 in number, 7–8 µm at midbody, posterior margin serrated except at tail. Excretory pore visible in one specimen, on 27th annule from anterior end. Stylet slender, 65–68 µm or 15–18% of body length, extends 13–14 annules ; metenchium 77–80% of stylet length ; basal knobs 8–9 µm wide. Orifice of dorsal oesophageal gland 9–10 µm behind base of stylet. Vulva located 9–10 annules from terminus, its

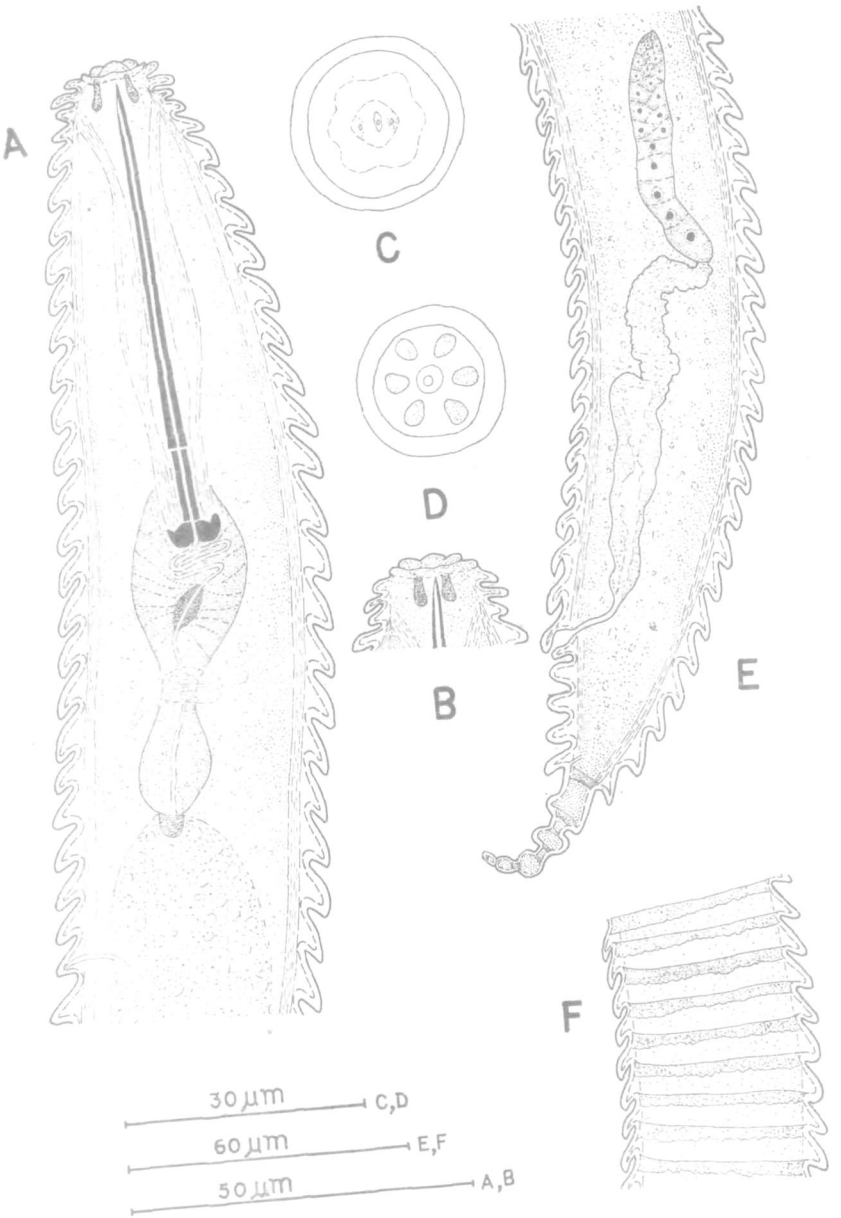

Fig. 1, *Nothocriconema degrissei* n. sp. : A-Anterior region ; B-Head end ; C-*En face* view ; D-Cross section at the level of lips ; E-Posterior region ; F-Body annules at mid-body.

anterior lip is larger and overhanging. Spermatheca non-functional. Tail conspicuously conoid.

Type habitat and locality : Soil around roots of tea at Lebong, district Darjeeling, West Bengal, India.

Differential diagnosis : *Nothocriconema degrissei* n. sp. comes close to *N. victoriae* Heyns, 1970 in having a conoid tail, but differs from it in having a differently shaped lip region, body annules directed posteriorly with serrated posterior margins and a longer stylet (first labial annule distinct, widest and slightly posteriorly directed ; body annules rounded and without serrated margins ; stylet 50–53 μm long in *N. victoriae*).

The new species is named after Dr. Andre T. de Grisse of Gent, Belgium.

PARATYLENCHUS DIANTHUS Jenkins & Taylor, 1956

10 ♀♀ : L=0.34–0.41 mm ; a=22–33 ; b=4.0–4.9 ; c=11–13 ; V=82–85 ; Stylet=23–26 μm.

Habitat and locality : Soil around roots of tea at Dagapur Tea Estate, 10 km from Siliguri on Siliguri-Darjeeling Road, West Bengal.

Remarks : There is general agreement in the measurements and other characters of this population with the original description and illustration of *P. dianthus* except the round conoid head (head round truncate in type specimens).

GRACILACUS JANAI N. SP.
(Fig. 2, A-I)

15 ♀♀ (paratypes) : L=0.26–0.30 mm ; a=18–23 ; b=2.4–2.9 ; c=12–13 ; V=$^{9-18}$73–77.

1 ♂ (paratype) : L=0.22 mm ; a=18 ; b=3.4 ; c=13 ; T=40.

Female (Holotype) : L=0.27 mm ; a=18 ; b=2.8 ; c=12 ; V=^{13}77.

Female : Body ventrally arcuate upon fixation, tapering gradually towards both ends. Cuticle marked with transverse striae, 1–2 μm apart. Lateral fields marked with two smooth incisures, about 1/7th-1/6th of body-width near middle. Head narrow and flat, sclerotization light. Excretory pore 68–85 μm from anterior end. Hemizonid 1–2 annule wide, usually a little above or below excretory pore. Stylet 54–59 μm long or 19–22% of body length ; metenchium 88–91% of stylet length ; basal knobs rounded about 3 μm wide. Orifice of dorsal oesophageal gland 5–6 μm behind base of stylet. Median bulb 7–8 μm wide with 8–10 μm long crescentic valve plates. Isthmus 9–13 μm long, encircled by nerve ring anteriorly, extending to a pyriform terminal bulb (10–14 x 6–8 μm). Vulvar

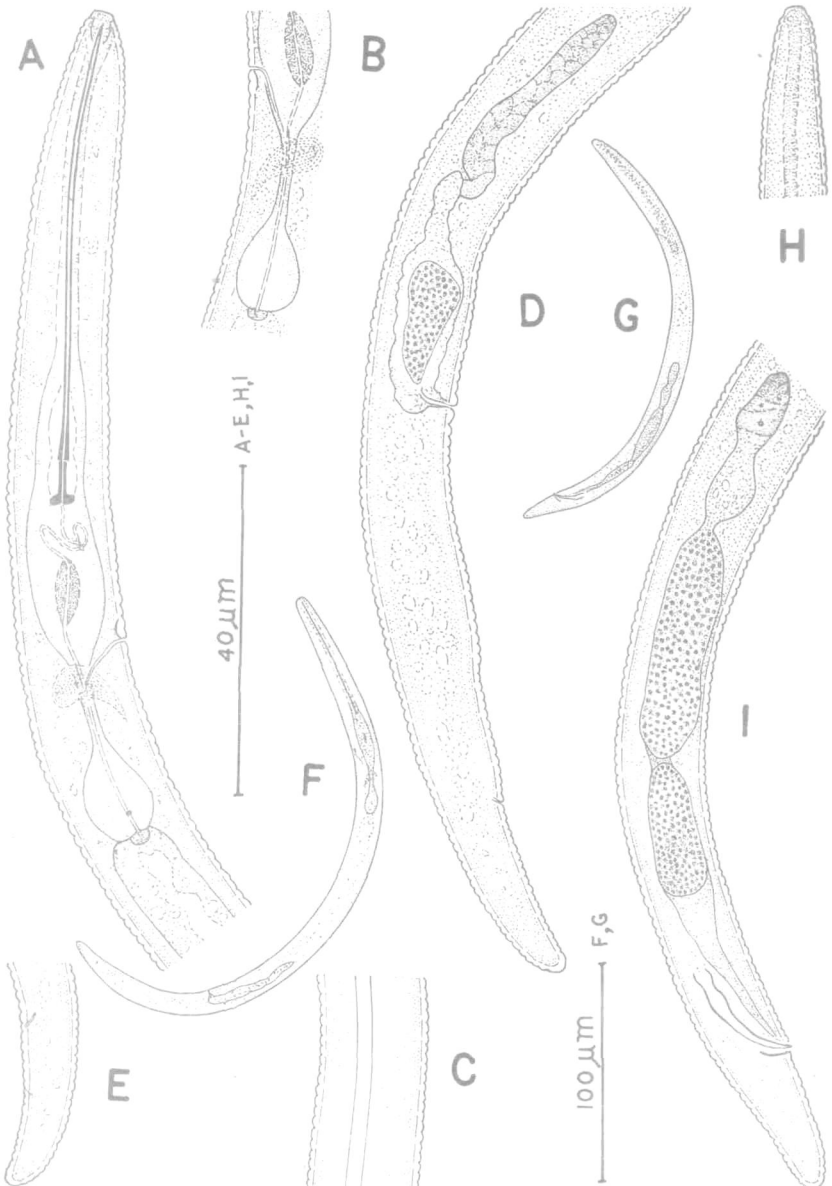

Fig. 2, *Gracilacus janai* n. sp. : A-F : Female, A-Anterior region ; B-Excretory pore above the hemizonid ; C-Lateral fields at mid-body ; D-Posterior region ; E-Tail region ; F-Entire female ; G-I : Male, G-Entire male ; H-Anterior end ; I-Posterior region.

lips slightly protrude, lateral vulvar membrane absent. Spermatheca filled with sperms. Tail cylindrical with bluntly rounded tip, marked with 16–20 annules ventrally.

Male : Body ventrally curved upon fixation. Lateral fields marked with two incisures, 1/6th of body-width near middle. Head similar to female. Excretory pore 57 µm from anterior end. Stylet absent. Oesophagus degenerated. Spicules slightly curved, 18 µm long. Gubernaculum 5 µm long. Tail short, cylindrical with bluntly rounded terminus, marked with 14 annules ventrally.

Type habitat and locality. Soil around roots of paddy at Saldah, district Burdwan, West Bengal, India.

Differential diagnosis : Gracilacus janai n. sp. comes close to *G. peperpotti* Schoemaker, 1963 in having lateral fields marked with two incisures, but differs in having shorter stylet, cylindrical tail and no lateral vulvar membrane (stylet 68-76 µm, tail conoid and lateral vulvar membrane present in *G. peperpotti*).

The new species is named after Mr. Amalendu Jana, Zoological Assistant, Zoological survey of India, Calcutta.

I thank Dr. T. N. Ananthkrishnan, Director ; Dr. K. C. Jayaram, Deputy Director ; and Dr. T. D. Soota, Superintending Zoologist, Zoological Survey of of India, Calcutta for providing research facilities.

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NEMATODES FROM WEST BENGAL (INDIA) IV. THREE KNOWN AND TWO NEW SPECIES OF THE GENUS *DORYLAIMOIDES* THORNE & SWANGER, 1936 (LEPTONCHIDAE : DORYLAIMIDA)

By

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(With 2 Text-figures)

INTRODUCTION

This is the fourth paper on the series "Nematodes from West Bengal (India)" which deals with three known and two new species of the genus *Dorylaimoides* Thorne & Swanger, 1936 belonging to the family Leptonchidae Thorne, 1935. The known species, viz. *Dorylaimoides parateres* Siddiqi, 1964, *D. pakistanensis* Siddiqi, 1964 and *D. modestus* Siddiqi, 1965, are being reported here for the first time from West Bengal.

It is to be noted that family Dorylaimoididae Siddiqi, 1969 and superfamily Leptonchoidea (Thorne, 1935) Ferris, 1971 are not recognized here.

Dorylaimoides parateres Siddiqi, 1964

1964. *Dorylaimoides parateres* Siddiqi, *Nematologica*, 9 : 628.
1969. *Dorylaimoides parateres* Baqri & Jairajpuri, *Nematologica*, **15** : 419.

Measurements:

Females (2): L=1. 44-1. 61 mm; a=39-42; b=6.6-7.3; c=58-65; $V=^{10-11}$ 44-46 $^{10-11}$.

Habitat and locality: Soil around roots of paddy at Tufangunj—Cooch Behar Road, Tufangunj, District Cooch Behar.

Dorylaimoides pakistanensis Siddiqi, 1964

1964. *Dorylaimoides pakistanensis* Siddiqi, *Nematologica*, 9 : 630.

Measurements:

Females (2): L= 1.16-1.21 mm; a=36-38; b=6.0-6.4; c=11-13; $V=^{11-12}$ 39-40 $^{11-13}$.

Habitat and locality: Soil around roots of banana from Chakchaka, District Cooch Behar.

Dorylaimoides modestus Siddiqi, 1965

1965. *Dorylaimoides modestus* Siddiqi, *Nematologica*, **11** : 102.

Measurements:

Female (1) : L=1. 04 mm; a=45; b=6.2; c=19, $V=^{8}36^{12}$.

Habitat and locality: Soil around roots of litchi from Siliguri, District Jalpaiguri.

Dorylaimoides loofi sp. n.

(Text-fig. 1)

Holotype (♀) : L=0.73 mm; a=29; b=5.0; c=32; $V=^{13}47^{14}$.

Paratype (♀) : L=0.78 mm; a=30; b=5.1; c=31; $V=^{13}48^{12}$.

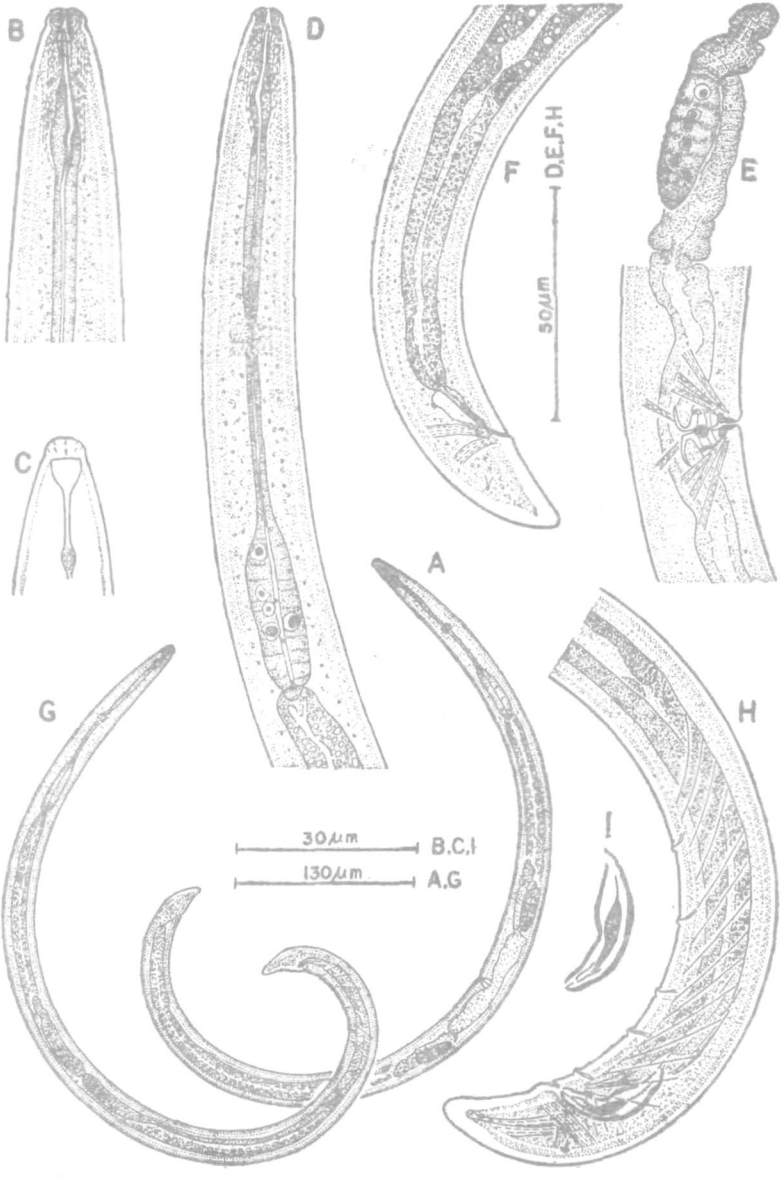
Paratype (♂) : L=0.72 mm; a=31; b=4.7; c=30; T=57.

Description:

Female : Body 'C' shaped upon fixation, tapering slightly towards both extremities. Culticle finely striated transversely; its thickness about 1 μm in mid-body and 4 μm at tail. Lateral chords granular, about 1/6th the body-width near middle. Ventral, dorsal and lateral body pores not distinct.

Lip region offset by a slight constriction from body, nearly rounded 1/3.5—1/3.0 of body-width at base of oesophagus. Amphids stirrup shaped, apertures occupying 4-5 μm or 65-69% of the corresponding body-width and 3-4 μm from anterior extremity. Sensillar pouches 15-17 μm from amphidial apertures.

Odontostyle measures 7-8 μm dorsally and 9-10 μm ventrally or 1.1-1.2 and 1.3-1.4 lip region-width long dorsally and ventrally respectively, diverging at base; aperture about 2 μm long. Thickness of odontostyle less than the cuticle-width in corresponding region. Guiding ring 5-6 μm or 0.8-0.9 lip region-width from anterior extremity. Odontophore curved, 13-14 μm long. The anterior slender part of oesophagus gradually expands to form the basal expanded portion.



Text-fig. 1. *Dorylaimoides loofi* sp. n. : A-F. Female. A—Entire female, B—Anterior end, C—Surface view of anterior end, D—Oesophageal region, E—Anterior gonad, F—Posterior region. G—I. Male. G—Entire male, H—Posterior region, I—Spicule and lateral guiding piece.

The basal expanded portion of oesophagus occupying 24-26% of neck

region. Locations of oesophageal gland nuclei and their orifices as follows:

DO=76. 0-78.4	S_1N_1=86-89	S_2N=91-93
DN=78. 6-81.0	S_1N_2=88-90	S_2O=93-95
DO—DN=2.6		
K=82-92	K′=87-94	

Nerve ring 71-77 μm or 46-49% of neck region from anterior end. Oesophago-intestinal disc absent. Cardia about 3 μm long, rounded, enveloped by intestinal tissue. Prerectum 62-70 μm or about 4 anal body-width long. Rectum 17-18 μm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 12-13 μm or about 1/2 of the corresponding body-width; surrounded by sphincter, with moderately sclerotized distal region. Gonads didelphic, opposed. Uterus and oviduct separated by sphincter; oöcytes arranged in a single row except at growth region.

Tail conoid with blunt terminus, 23-25 μm or 1.4-1.5 anal body-width long; with one caudal pore on each side.

Male: Similar to female in general shape and morphology. Spicules 28 μm or about 1.5 anal body-width long, with a simple median piece. Lateral guiding pieces more or less rod-shaped, about 5 μm long. In addition to the adanal pair, four irregularly spaced ventromedian supplements; first ventromedian supplement anterior to spicule region. Subventral papillae not distinct. Copulatory muscles 14, reaching anterior to supplement region. Spermatozoa elliptical, 3-4 μm long. Prerectum starting anterior to couplatory muscles, 92 μm or about five anal body-width long. Tail similar to female, 24 μm or slightly more than 1.3 anal body-width long; with one caudal pore on each side.

Differential diagnosis: *Dorylaimoides loofi* sp. n. comes close to *D. teres* Thorne and Swanger, 1936 in having diverging base of odontostyle and short conoid tail with blunt terminus but it differs from the latter in having a shorter body (L=1.2-1.8 mm in *D. teres*); longer oesophagus (b=5.6-6.7 in *D. teres*); shorter enlarged part of oesophagus (enlarged part about 1/3rd of total oesophageal length in *D. teres*); nearly rounded lip region; one caudal pore on each side (two caudal pores on each side in *D. teres*); ventromedian supplements spaced irregularly, the series starting anterior to spicula region in male (ventromedian supplements spaced regularly and series starts within range of spicula in *D. teres*).

The species is named after Dr. P.A.A. Loof.

Type specimens: Holotype along with paratype female and male. mounted on slide WN 200/1.

Type habitat and locality: Soil around roots of banana from Fulbari, Tufanganj, District Cooch Behar; *Q. H. Baqri* Coll.

Dorylaimoides siddiqii sp. n.
(Text-fig. 2)

Measurements:

Holotype (♀): L=1.22 mm; a=38; b=6.7; C=21; V= $^{10}40^{12}$.

Paratype (3♀): L=1.10-1.19 mm; a=35-37; b=5.7-6.5; c=20-21; V=$^{9-13}$ 39-40 $^{10-13}$

Paratype (♂): L=1.13 mm; a=38; b=6.1; c=28; T=60.

Description:

Female: Body ventrally curved in posterior half upon fixation, tapering slightly towards both extremities. Cuticle finely straited transveresely; its thickness about 2 μm in mid-body and about 4 μm at tail. Lateral chords granular, 1/6th-1/5th the body-width near middle. Lateral, ventral and dorsal body pores not distinct.

Lip region offset from body by a slight constriction, 1/3.8-1/3.5 of body-width ats base of oesophagus. Amphids stirrup-shaped, divided into two parts by a faint transverse line; apertures occupying about 5 μm or 62-66% of the corresponding body-width, about 4 μm from anterior end. Sensillar pouches 16-18 μm from amphidial apertures.

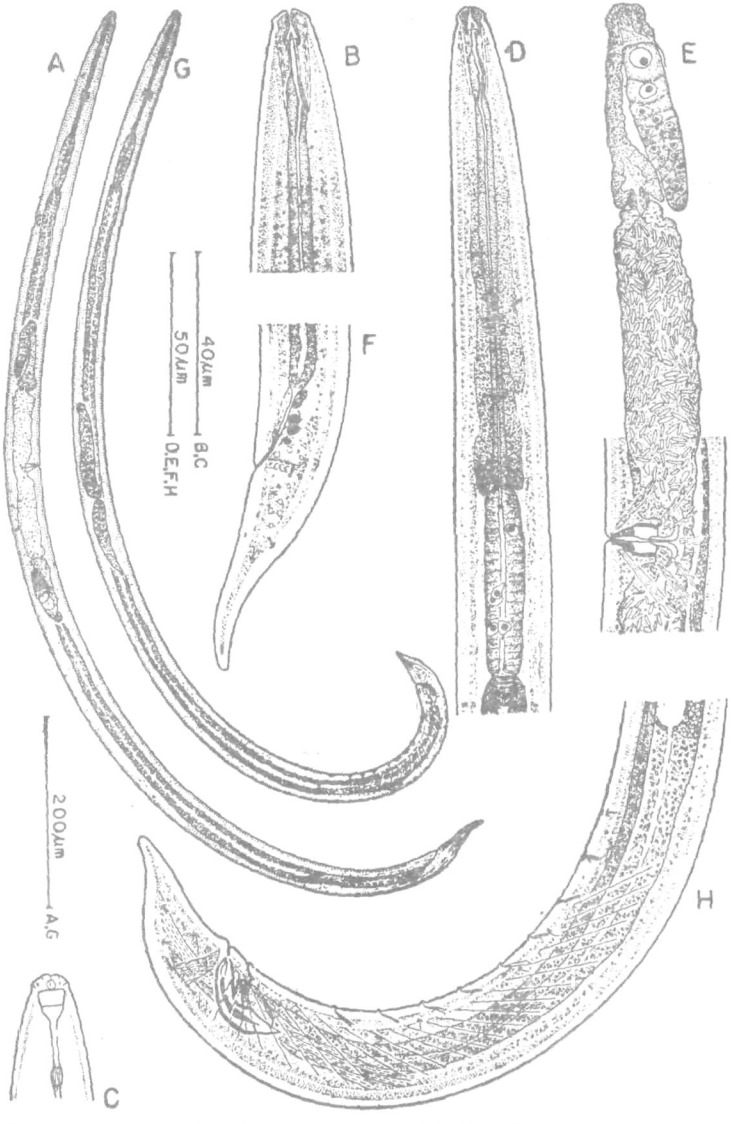
Odonotostyle 8-9 μm or 1.0-1.1 lip region width long, thickness less than the corresponding cuticle-width; aperture about 2 μm. Guiding ring 6 μm or about 0.8 lip region width from anterior end. Odontophore curved, 11-13 μm or 1.4-1.6 times the odontostyle length. Anterior slender part of oesophagus non-muscular while basal expanded part muscular, the two parts separated by a constriction. Basal expanded part of oesophagus occupying 27-30% of neck region in width. Locations of oesophageal gland nuclei and their orifices as follows:

DO=73.7-74.8	$S_1 N_1$ =84.0-87.8	S_2 O=91-93
DN=78.0-78.8	$S_1 N_2$ =85-89	S_2 N=92-94
DO—DN=3.2-5.0		
K=87-92	K'=80-86	

Nerve ring 82-86 μm or 43-46% of neck region from anterior end. Oesophago-intestinal disc absent. Cardia tongue-shaped, 5-7 μm long,

enveloped by intestinal tissue. Prerectum 92-130 μm or 4.4-6.2 times the anal body-width long. Rectum 20-24 μm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 17-20 μm or more than half corresponding body-width, with slightly sclerotized



Text-fig. 2. *Dorylaimoides siddiqii* sp. n.: A-F. Female. A—Entire female, B—Anterior region, C—Surface view of anterior region, D—Oesophageal region, E—Anterior gonad, F—Tail region. G—H. Male. G—Entire male, H—Posterior region.

distal region. Gonads didelphic, opposed. Uterus and oviduct separated by sphincter; uteri often packed with sperm; sperm elliptical, 4-5 μm long. Oöcytes arranged first in a single row then in double rows.

Tail elongate digitate, usually slightly bent dorsally, 53-59 μm or 2.5-2.8 anal body-width long; with two caudal pores on each side.

Male: Similar to female in general shape and morphology except that the posterior end curved more ventrally. Spicules 30 μm or about 1.4 anal body-width long, with a simple median piece. Lateral guiding pieces more or less rod-shaped, 4-5 μm long. In addition to the adanal pair, 8 regularly spaced ventromedian supplements. The first ventromedian supplement situated much anterior to spicula region. Only 4 subventral papillae could be obserevd. Copulatory muscles 23 in number, reaching up to 7th ventromedian supplement. Prerectum 170 μm or about 7.7 anal body-width long, starting much before supplement region. Tail similar to female but shorter, 41 μm or 1.9 anal body-width long; with two caudal pores on each side.

Differential diagnosis: In having elongate digitate tail and posterior end bent dorsally, *Dorylaimoides siddiqii* sp. n. comes close to *D. micoletzkyi* (de Man, 1921) Thorne & Swanger, 1936 but it differs from the latter in having offset lip region (lip region almost continuous with neck contour in *D. micoletzkyi*); differently shaped amphids (amphidial apertures wider and pouch without partition line in *D. micoletezkyi*); vulva without muscular labia (vulva with muscular labia in *D. micoletzkyi*); differently shaped vagina; in male first ventromedian supplement situated much anterior to spicula region (first ventromedian supplement situated within range of spicula in *D. micoletzkyi*), ventromedian supplements spaced regularly (ventro-median supplements spaced irregularly in *D. micoletzkyi*).

The species in named after Dr. M. R. Siddiqi.

Type specimens: Holotype along with paratype male on slide WN 201/1; 3 paratype females on slide WN 202/1.

Type habitat and locality: Soil around roots of litchi from Jalpaiguri More, Siliguri, District Jalpaiguri; *Q. H. Baqri* Coll.

SUMMARY

Dorylaimoides parateres Siddiqi, 1964; *Dorylaimoides pakistanensis* Siddiqi, 1964 and *Dorylaimoides modestus* Siddiqi, 1965 have been reported for the first time from West Bengal. Apart from these three known species, *Dorylaimoides loofi* sp. n. and *Dorylaimoides siddiqii* sp. n. have also been described.

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NEMATODES OF AGRICULTURAL CROPS IN INDIA

I. DISTRIBUTION OF NEMATODES ASSOCIATED WITH FIBROUS CROPS IN UTTAR PRADESH

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Our knowledge of the nematodes associated with fibrous crops in India is very meagre, Luthra & Vasudeva (1939), Luthra (1940), Thapar (1941), Siddiqi (1964) and others recorded some nematodes from cotton but no attempt has been made to carry out qualitative and quantitative surveys of nematodes so as to obtain their complete record. In recent years Baqri & Jairajpuri (1966-70) have published a number of papers on the taxonomic studies of nematodes associated with fibrous crops in India, specially Uttar Pradesh.

During 1966-69 some economically important fibrous crops in Uttar Pradesh were surveyed to determine the distribution of nematodes. About 400 soil samples were collected from 91 different localities in 23 districts. The present paper deals with the distribution of nematodes belonging to the Orders Tylenchida, Dorylaimida and Mononchida. The crops selected include three species of cotton, viz., *Gossypium hirsutum* L., *G. herbaceum* L., and *G. arboreum* L.; the Sun hemp, *Crotalaria juncea* L.; and the Patson, *Hibiscus cannabinus* L. The samples upon analysis yielded 51 genera belonging to 24 families of the above Orders. In all 86 species were identified, whereas few species remained unidentified. The texture of soil and pH value of spmple were noted to see their effects on nematode population.

In Table I, the alphabets under the colums of the host(s) and the number under district(s) refer to the followings :

HOSTS : A— *Gossypium hirsutum* B — *Gossypium herbaceum*
C— *Gossypium arboreum* D— *Crotalaria juncea*
E— *Hibiscus cannabinus*

DISTRICTS : 1. Agra 3. Allahabad
2. Aligarh 4. Badaun

*Present address : Zoological Survey of India, Calcutta.

5. Banaras
6. Bijnor
7. Bulandshahr
8. Etah
9. Etawah
10. Ghazipur
11. Jalaun
12. Jhansi
13. Kanpur
14. Mainpuri
15. Mathura
16. Meerut
17. Mirzapur
18. Moradabad
19. Muzaffarnagar
20. Rampur
21. Saharanpur
22. Shahjahanpur
23. Nainital

TABLE I

SPECIES	HOST(S)	DISTRICT(S)
Family : Tylenchidae Orley, 1880		
Tylenchus davaini Bastian, 1865	A B — D E	4, 6-8, 12, 15-21.
T. striatus Das, 1960	— B — D —	5,12.
T. leptus Siddiqi, 1963	A B — D —	2,5,12,14,
Ditylenchus nanus Siddiqi, 1963	A B — D —	2,4-8, 14-16, 18-20.
D. mirus Siddiqi, 1963	A B — — E	2, 9, 11, 12, 16, 17, 21.
D. microdens Thorne & Malek, 1958	— — — D —	5.
Pseudhalenchus anchilisposomus Tarjan, 1958	— — — D —	12.
Psilenchus minor Siddiqi, 1963	— — — D —	12.
P. neoformis Jairajpuri, 1963	— B — — —	19.
Basiria graminophila Siddiqi, 1963	— B — — —	20.
Clavilenchus tumidus (Colbran, 1960) Thorne & Malek, 1968	— B — — —	6.
C. ritteri Baqri & Jairajpuri, 1969	— B — D —	1, 21.
Family : Tylenchorhynchidae (Eliava, 1964) Golden, 1971		
Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959	— B — D E	1-3, 5-10, 13, 16, 17, 19-22.
T. martini Fielding, 1956	— — — — E	23.
T. goffarti Sturhan, 1966	— — — — E	5.
T. divittatus Siddiqi, 1961	— B — D —	3, 5, 9, 11-13, 17.
T. brassicae Siddiqi, 1961	— B C D —	2-4, 7, 9, 12, 14-16, 19-21.
Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971	— — — D —	23.
Merlinius brevidens (Allen, 1955) Siddiqi, 1970	— B — — —	16.

TABLE I (Continued)

SPECIES	HOST(S)	DISTRICT(S)
Family : Hoplolaimidae (Filipjev, 1934) Wieser, 1953		
Hoplolaimus indicus Sher, 1963	A B C D E	1-22.
Helicotylenchus erythrinae (Zimmermann, 1904) Golden, 1956,	— — — — E	5, 12.
H. pseudorobustus (Steiner, 1914) Golden, 1956	— B — — —	21.
H. indicus Siddiqi, 1963	A B C D —	1, 2-6, 8-16, 19-22.
H. retusus Siddiqi & Brown, 1964	A B — D E	2, 7, 8, 12, 13, 16, 18, 21
H. digitatus Siddiqi & Husain,1964	— B C — —	7, 16, 19.
Rotylenchus sp.	— B — — —	19.
Family : Belonolaimidae (Whitehead, 1959) Golden, 1971		
Telotylenchus aerolatus Baqri & Jairajpuri, 1969	— — — D —	12.
Family : Pratylenchidae (Thorne, 1949) Siddiqi, 1963		
Pratylenchus thornei Sher & Allen, 1953.	A B C D E	2. 3, 5, 7-9, 11-22.
Hirschmanniella oryzae (Soltwedel, 1889) Luc & Goodey, 1963	— — — D —	11,13.
Family : Nacobbidae (Chitwood & Chitwood, 1950) Golden, 1971		
Rotylenchulus reniformis Linford & Oliveira, 1940	— B — — —	16,19.
Family : Nothotylenchidae (Thorne, 1941) (Jairajpuri & Siddiqi), 1969		
Dorsalla indica Jairajpuri, 1966	— B — — —	2
Family Criconematidae (Taylor, 1936) Thorne, 1949		
Hemicriconemoides sp.	— B — — —	16.
Family : Hemicycliophridae (Skarbilovich, 1959) Geraert, 1966.		
Hemicycliophora eugeniae Khan & Basir, 1963	— B — — —	16.
Family : Paratylenchidae (Thorne, 1949) Raski, 1962		
Paratylenchus sp.	— B — — —	4.
Family : Aphelenchidae (Fuchs, 1937) Steiner, 1949		
Aphelenchus avenae Bastian, 1865	A B C D E	1-22.
Family Dorylaimidae DeMan, 1876		
Eudorylaimus spp.	A B C D E	1-23,
Mesodorylaimus spp.	A B C D E	1-22.

TABLE I (Continued)

SPECIES	HOST(S)	DISTRICT(S)
Labronema spp.	A B C D E	1-22,
Thornenema mauritianum (Williams, 1959) Baqri & Jairajpuri, 1967	A B C D —	2, 4, 6-9, 15, 16, 18, 22.
Discolaimus major Thorne, 1939	— B — D —	3, 7, 17. 19,
D. similis Thorne, 1939	— B — D —	4, 5, 7, 14, 16, 21.
D. brevis Siddiqi, 1964	A B — D —	2, 3, 5, 12, 13, 15, 16, 19. 21.
D. tenax Siddiqi 1964	A B — D E	2, 10, 12, 17, 20.
Discolaimium bulbiferum (Cobb, 1906) Timm & Bhuiyan, 1963	— B C D —	2, 3-5, 10-22.
D. monhystera Siddiqi, 1965	— — — D —	17.
D. simplex Siddiqi, 1965	— — — D —	17.
D. brachyurum Husain & Siddiqi, 1967	— — C — E	6,17.
D. arcuatum Husain & Siddiqi 1967	— — — D —	5,12.
D. upum Baqri & Jairajpuri, 1968	A B — — —	2,8.
D. mukhtarpuriensis Baqri & Jairajpuri, 1969	A B C — —	6,10,20.
Pungentus angulatus Jairajpuri & Baqri, 1966	A — — — —	2.
Family : Aporcelaimidae Heyns. 1965		
Aporcelaimellus heynsi Baqri & Jairajpuri, 1968	— B C — —	2,6,7,14,16.
A. indicus Baqri & Jairajpuri 1968	A — — — —	14.
Aporcelaimellus sp.	— B — D —	1,10,14.
Sectonema procta Jairajpuri & Baqri, 1966	— B — — —	18.
Family : Longidoridae (Thorne, 1935) Meyl, 1961		
Longidorus sylphus Thorne, 1939	— B — — —	21.
L. laevicapitatus Williams, 1959	— B — — E	17,21.
L. brevicaudatus (Schuurmans Stekhoven, 1951) Thorne, 1961	A B C D E	1-3,5-9,11,13-19,21.
Xiphinema americanum Cobb, 1913	— B — D E	3,5,10,13,16,17,21.
X. basiri Siddiqi, 1959	— — — D —	12.
Paralongidorus citri (Siddiqi, 1959) Siddiqi et al., 1963	— B C — E	3,4,7,11,13,16,17,21.
P. microlaimus Siddiqi. 1964	— B — — —	21.
Family , Leptonchidae Thorne, 1935		
Leptonchus granulosus Cobb, 1920	— B — D —	6-9,16-19,21,22.

TABLE I (Continued)

SPECIES	HOST(S)	DISTRICT(S)
L. capitatus Baqri & Jairajpuri, 1968	A — — —	— 19.
Proleptonchus aestivus Lordello, 1955	— B — —	— 21.
Dorylaimoides arcuatus Siddiqi, 1963	A B — D	— 3,7,9,13,16,18,19.
D. parateres Siddiqi, 1963	— — — D	— 5.
D. constrictus Baqri & Jairajpuri, 1969	— — — D	— 5.
D. saueri Baqri & Jairajpuri, 1969	— B — D	— 6.12.
D. arcuicaudatus Baqri & Jairajpuri, 1969	— — — —	E 12.
Morasia dimorphicauda Baqri & Jaiarjpuri, 1969	— B C —	— 13,19,21.
Tylencholaimellus eskei Siddiqi & Khan, 1964	— B — —	— 16,19.
T. sayeedi Siddiqi, 1965	— — C —	— 20.
Tyleptus variabilis Jairajpuri & Loof, 1966	— — C —	— 4,18.
Tylencholaimus minimus De Man, 1876	— B — D	— 12,13,17,19.
T. leptonchoides Loof, 1964	— B — —	— 7,9.
T. obscurus Jairajpuri, 1965	A B C D	— 1,2,4,5.8,10,12,14,16,19, 21.
Family : Belonenchidae Thorne, 1964		
Basirotyleptus basiri Jairajpuri, 1964	— B — D	— 12,13,16.
Family : Nygolaimidae (Thorne, 1935) Meyl, 1961		
Nygolaimus spp.	A B C D	E 1-8,10-23.
Family : Actinolaimidae (Thorne, 1939) Meyl. 1961		
Neoactinolaimus sp.	A B — —	— 2,6,13.
Family : Belondiridae Thorne, 1939 emend. 1964		
Belondira paraclava Jairajpuri, 1964	— B — D	— 5,9,11,12,17,19-21.
Oxydirus magnus Timm, 1964	— — — D	— 5.
O. gigas Jairajpuri, 1964	— — — D	— 6.
Dorylaimellus parvulus Thorne, 1939	— — C D	— 11,12,16.
D. projectus Heyns, 1962	— — — D	— 3.
D. directus Heyns, 1963	— B — —	— 7,13,19,21.
D. longicaudaudatus Jairajpuri, 1964	— B — D	— 7-9,12,21.

TABLE I—(Continued)

SPECIES	HOST(S)					DISTRICT(S)
D. discocephalus Siddiqi, 1964	—	B	C	D	—	2,4-9,11,12,14,16-19,21
D. indicus Siddiqi, 1964	—	B	C	D	E	1-3,6-12,14-17,19,21
D. jacobi Baqri & Jairajpuri, 1968	—	B	—	D	—	7.16,21.
D. deviatus Baqri & Jairajpuri, 1968	—	—	C	—	—	20.
Family: Diphtherophoridae (Micoletzky, 1922) Thorne. 1955						
Diphtherophora sp.	A	B	—	—	—	7,20.
Family : Trichodoridae (Thorne, 1935) Clark, 1961						
Paratrichodorus mirzai (Siddiqi, 1960) Siddiqi, 1974	—	B	—	D	E	7,11-13,16,19,21.
Family : Alaimidae Micoletzky, 1922						
Amphidelus dudichi Andrassy, 1957	—	B	—	—	—	7,16.
A. novus Baqri & Jairajpuri, 1968	—	—	C	—	—	20.
Family : Mylonchulidae Jairajpuri, 1969						
Mylonchulus spp.	A	B	—	D	E	2,4,12,16,19,23.
Family : Bathyodontidae Clark, 1961						
Oinchus obtusus Cobb, 1913	—	B	—	—	—	7.

DISCUSSION

Among the plant parasitc genera, species of *Tylenochorhynchus* were most abundant and present nearly in all the samples, generally dominating over other parasitic forms. *Hoplolaimus indicus* was present in 95% samples but dominating only in 5% of them. The species of *Helicotylenchus* and *Pratylenchus* were found in 70% and 40% of the samples respectively and nearly in 7% of the samples they were dominating forms. *Tylenchus* and *Ditylenchus* were present in 60% and 50% of the samples respectively but in small numbers. The species, *Aphelenchus evenæ* was quite numerous in 30% of the samples. *Longidorus brevicaudatus* was recovered from 15% and *Paralongidorus citri* from about 5% of the samples. *Paratrichodorus mirzai* has also been found from about 10 samples but only few specimens were recovered. The remaining genera of

this group were found occasionally and in insignificant numbers. *Rotylenchulus reniformis* was found only in few samples but in two samples from Muzaffarnagar district its degree of dominance was exceptionally very high. The genera *Tylenchorhynchus* and *Hoplolaimus* are probably more specific to the cotton crop than other genera in Uttar Pradesh. The species *Tylenchorhynchus mashhoodi, T. brassicæ, T. divittatus and Hoplolaimas indicus* were most abundant.

Among the non prasitic genera, the species of *Eudorylaimus, Mesodorylaimus, Labronema, Thornenema, Discolaimus, Discolaimium, Nygolaimus and Dorylaimellus* were most abundant in this region.

It was noted that the loam and sandy-loam texture of the soil was most favourable for high nematode populations as compared to clavey-loam. The sandy-loam texture seems favourable for the genera *Longidorus. Xiphinema* and *Paralongidorus.* The presence of the genera *Tylenchorhynchus, Hoplolaimus, Helicotylenchus, Pratylenchus, Aphelenchus, Eudorylaimus, Mesodorylaimus, Labronema, Thornenema, Discolaimus, Discolaimium, Nygolaimus* and *Dorylaimellus* in most of the soil samples examined in this project is probably due to the fact that they are quite resistant to the changes in pH and also do not have any particular preference for the soil type. From the present study no definite conclusion could be drawn about the affects of the varriations in the pH of the soil on nematode populations.

SUMMARY

In the years 1966-69, about 400 soil samples from around the roots of fibrous crops in Uttar Pradesh were collected from 91 different localities of 23 districts. The crops surveyed include three species of Cotton, viz., *Gossypium hirsutum* L., G. *herbaceum* L., and *G., arboreum* L. ; the Sun hemp, *Crotalaria juncea* L. ; and Patson, *Hibiscus cannabinus* L. In the present paper, 86 species, 51 genera belonging to 24 families of the Orders Tylenchida, Dorylaimida and Mononchida have been reported.

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TWO NEW SPECIES OF DORYLAIMIDAE (DORYLAIMIDA : NEMATODA) FROM TAMIL NADU, INDIA

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ABSTRACT

Two new species of nematodes belonging to the family Dorylaimidae de Man, 1876 have been described. One of these new species of the genus *Oriverutus* Siddiqi, 1971, described as *O. arcuatus*, is characterized by having subangular lips, 13-14 µm long odontostyle, 13-16 µm long odontophore and amphidelphic female reproductive system. The other new species belongs to the genus *Chitwoodius* Furstenberg & Heyns, 1966, named as *C. seshadrii*, which is distinguished by a set off lip region with centrally protruding portion, 25-29 µm long odontostyle, 22-26 µm long odontophore and the amphidelphic female reproductive system with less developed ovaries.

INTRODUCTION

While carrying out the faunistic survey of district Salem, Tamil Nadu in December, 1975, a tour party led by Dr. A. N. T. Joseph from the Zoological Survey of India collected few soil samples from around roots of coffee. These samples yielded a new species of the genus *Oriverutus* Siddiqi, 1971 and one new species of the genus *Chitwoodius* Furstenberg and Heyns, 1966. The genus *Chitwoodius* has been recorded for the first time from India.

MATERIAL AND METHODS

The nematodes were fixed in hot 4% formalin, dehydrated slowly in desiccator and mounted in anhydrous glycerine. The type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta. *Oriverutus arcuatus :* Holotype female along with paratype male mounted on slide WN/308 ; *Chitwoodius seshadrii* : Holotype and 8 paratype females mounted on slides WN/309-310.

Oriverutus arcuatus n. sp.

(Fig. 1)

Dimensions : Holotype female : L= 0.79 mm ; a=33 ; b=3.7 ; c=15 ; V=$^{12}50^{13}$.

Paratype male : L=0.82 mm ; a=37 ; b=4.0 ; c=13 ; T=48.

Description : Body ventrally curved upon fixation, tapering gradually towards both ends. Cuticle transversely striated, 1—2 µm thick (thickest on tail). Lateral, ventral and

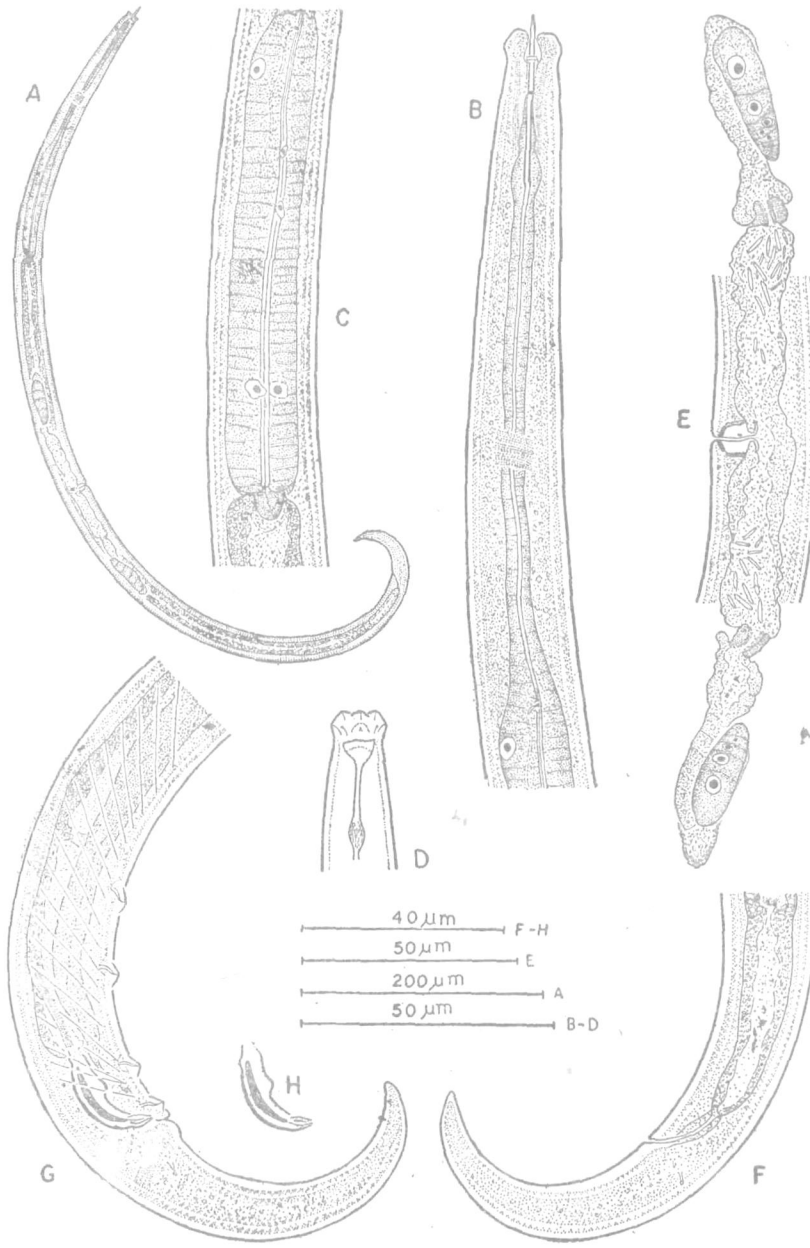

Fig. 1 *Oriverutus arcuatus* n. sp. A.—Entire ♀, B—Anterior region, C—Basal expanded part of oesophagus region, D—Surface view of anterior end, E—♀ reproductive system, F—Posterior region of ♀, G—Posterior region of ♂, H—Spicule and lateral guiding piece.

dorsal body pores not distinct. Lateral chords about $\frac{1}{3}$rd of body-width near middle. Lip region set off, wider than adjoining body, about $\frac{1}{2}$ of body-width at base of oesophagus ; lips subangular bearing the usual number of papillae. Amphids cup-shaped ; their apertures 5—6 µm from anterior extremity and 6 µm wide or occupying 65% of the corresponding body-width. Sensillar pouches 17—18 µm from amphidial slits.

Odontostyle narrow, 13—14 µm or about 1.2 head-width long ; aperture 2.5 µm or about 20% of odontostyle length. Odontophore 13—16 µm or 1.0—1.2 times the odontostyle length. Guiding ring 6—7 µm or about 60—65% of head-width from anterior end. Basal expanded part of oesophagus occupies 43—44% of the total oesophageal length. Nerve ring located at 77—80 µm or 37—38% of oesophageal length from anterior end. Cardia rounded, enveloped by intestinal tissue. Locations of oesophageal gland nuclei and their orifices in holotype as follows :

DO=59.7	S_1N_1=70	S_2N=91
DN=63.6	S_1N_2=75	S_2O=93
DO-DN=3.9		

Female : Vulva a transverse slit. Vagina extending inward 10 µm or less than $\frac{1}{2}$ of corresponding body-width, sclerotized distally. Reproductive system amphidelphic. Uterus and oviduct separated by a sphincter. Oocytes arranged in single row except at growth region. Sperms present in uteri. Prerectum 40 µm or about 3 anal body-widths long. Rectum 15 µm or about one anal body-width long. Tail ventrally arcuate conoid, 53 µm or about 4 anal body-widths long, with one caudal pore on each side.

Male : Spicules 22 µm medially. Lateral guiding pieces 5 µm long. In addition to the adanal pair, three ventromedian supplements present which are spaced nearly at regular intervals. Copulatory muscles 17, reaching anterior to the supplement region. Prerectum 42 µm or about 2.5 anal body-widths long. Tail ventrally arcuate conoid, 62 µm or about 3.5 anal body-widths long, with one caudal pore on each side.

Type habitat and locality : From soil around roots of coffee at Kumbakund, district Salem, Tamil Nadu.

Differential diagnosis : *Oriverutus arcuatus* n. sp. comes close to *O. hastatus* (Andrássy, 1963) Siddiqi, 1971 but differs from it in having more angular lips, differently shaped amphids (amphidial pouches more deeper in *O. hastatus*), shorter odontostyle (odontostyle 23—24 µm in O. *hastatus*), longer odontophore than odontostyle (odontophore shorter than odontostyle length in *O. hastatus*), distally sclerotized vagina and more arcuate tail.

Chitwoodius seshadrii* n. sp.

(Fig. 2)

Dimensions : Holotype female : L=1.65 mm ; a=27 ; b=4.6 ; c=61 ; $V=^{14}56^{13}$.

Paratype females (8) : L=1.21—1.71 mm ; a=28—31 ; b=4.0-4.6 ; c=50—68 ; $V=^{8-16}53\text{-}56^{9-13}$.

Description : Body slightly ventrally curved upon fixation, tapering slightly towards both ends. Outer cuticle smooth ; inner layer with transverse striae, irregularly wrinkled and loosened from outer layer ; 2-3 µm thick at mid-body and 5-7 µm thick on tail. Lateral chords $\frac{1}{4}$th-$\frac{1}{3}$rd of body-width near middle. Lateral body pores irregularly arranged on both the sides of lateral chords,

* The species is named after Dr. A. R. Seshadri, Joint Director and Dean, I. A. R. I., New Delhi.

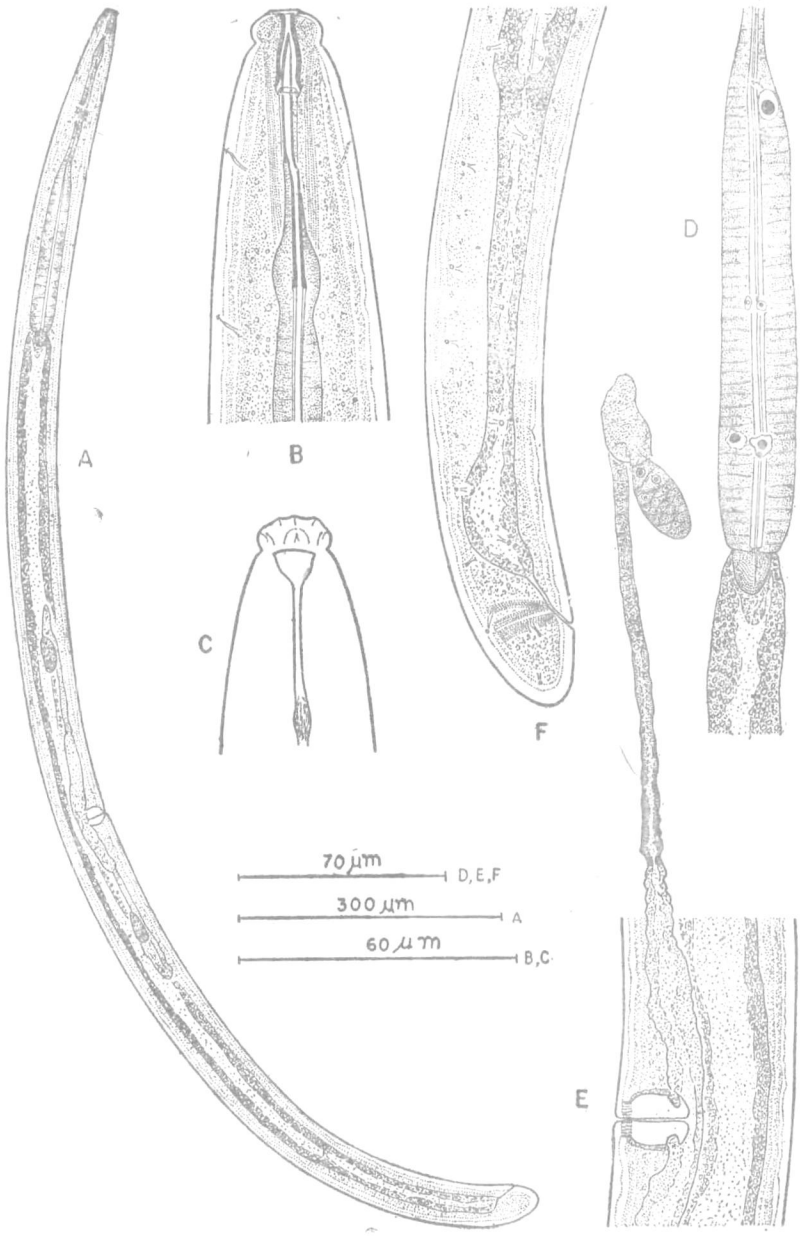

Fig. 2 *Chitwoodius seshadrii* n. sp., A—Entire ♀, B—Anterior region, C—Surface view of anterior end, D—Basal expanded part of oesophagus, E—Vulva region and anterior sexual branch, F—Posterior region.

83-102 in number ; of which 19-21 in oesophageal region, 59-68 between cardia and prerectum, 11-15 in prerectum-rectum region, and 3 in caudal region. Ventral body pores 5-8 and dorsal body pores 3. Lip region set off by a deep constriction, cap-like, the central portion somewhat protruding and forming a labial disclike structure, about $\frac{1}{3}$rd of body-width at base of oesophagus. Amphids cup-shaped ; apertures occupying about 8 µm or 55-58% of the corresponding body-width and situated at 6-7 µm from anterior extremity. Sensillar pouches 31-33 µm from amphidial slits.

Odontostyle 25-29 µm or 1.8-2.1 lip region-width long ; aperture 3-4 µm or 10-14% of its own length. Odontophore 22-26 µm or 0.8-0.9 times the odontostyle length. Guiding ring 16-18 µm or 1.1-1.3 lip region-width from anterior end. Basal expanded part of oesophagus occupies 46-49% of the total neck length. Oesophageal gland nuclei and their orifices as follows :

DO=52.4-54.7 S_1O=74-76 S_2N=90-91
DN=54.4-57.7 S_1N=75-77 S_2O=91-92
DO-DN=2.2-3.1

Nerve ring 108-129 µm or 32-35% of the oesophageal length from anterior end. Cardia rounded, enveloped by intestinal tissue. Prerectum 126-193 µm or about 4-5 anal body-widths long. Rectum 22-27 µm or less than one anal body-width long.

Vulva a transverse slit. Vagina with a thick-walled muscular tube having a fringed appearance. ; 19-25 µm long or extending inward less than $\frac{1}{2}$ of the corresponding body-width. Reproductive system amphidelphic. Uterus and oviduct separated by a weak sphincter. Ovaries reflexed, less developed ; oocytes arranged in multiple rows.

Tail rounded, 23-27 µm or 0.7-0.8 anal body-width long, with 3 caudal pores on each side.

Male : Not found.

Type habitat and locality : From soil around roots of coffee at Kumbakund, district Salem, Tamil Nadu.

Differential diagnosis : *Chitwoodius seshadrii* n. sp. comes close to *C. transvaalensis* Furstenberg and Heyns, 1966 but differs from it in having more set off and differently shaped lip region having a disc-like structure in the centre (lip region without a disc-like structure in *C. transvaalensis*), more posteriorly situated guiding ring (guiding ring 15-16 µm from anterior end in *C. transvaalensis*), oesophagus with only a single ellipsoidal swelling in odontophore region before nerve ring (oesophagus with two swellings anterior to nerve ring in *C. transvaalensis*), transverse vulva (vulva longitudinal in *C. transvaalensis*), and 3 caudal pores (caudal pores absent in *C. transvaalensis*).

ACKNOWLEDGEMENTS

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NEMATODES FROM WEST BENGAL (INDIA) V. REVIEW OF THE FAMILY THORNENEMATIDAE SIDDIQI, 1969 (DORYLAIMOIDEA: NEMATODA)

BY

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In view of the dissimilar tails found in the two sexes of *Sicaguttur sartum* Siddiqi, 1971 from West Bengal, males being reported for the first time, diagnosis of the genus *Sicaguttur* Siddiqi, 1971 is emended. A new species, *Sicaguttur longicaudatum*, is described from Azamgarh, India. *Jairajpuria shamimi* n. gen., n. sp. is proposed from West Bengal. *Jairajpuria* n.gen. differs from *Thornenema* in having an off-set and cap-like lip region, longer uterine sac, and S_2N more anteriorly situated from S_2O. *Mehdinema prabhae* n.gen.,[1]), n.sp. is proposed for *S. sartum* apud Ali & Prabha, 1974. *Mehdinema* n.gen. differs from *Sicaguttur* mainly in having similar tails in both sexes. *Mehdinema indicum* (Ali & Prabha, 1974) n.comb. is proposed for *Sicaguttur indicum*. *Mehdinema coomansi* n.sp. is also described from West Bengal and is compared with *M. prabhae* and *M. indicum*. After comparing the paratype females of *Thornenema wickeni* Yeates, 1970 with the Indian specimens having similar tails in the sexes which were identified as *T. wickeni* by Ali & Prabha (1974) and for which they proposed a new genus *Indodorylaimus*, we conclude that Ali & Prabha misidentified the Indian specimens and *T. wickeni* is well placed under *Thornenema*. The diagnosis of the family Thornenematidae is emended. The genera *Thornenema*, *Sicaguttur* and *Jairajpuria* n.gen. are grouped in the subfamily Thornenematinae and the subfamily Sicagutturinae Ali & Prabha, 1974 is not recognized. A new subfamily Mehdinematinae[1]) is proposed under Thornenematidae for the reception of *Mehdinema* n.gen., *Willinema* Baqri & Jairajpuri, 1967, *Indodorylaimus* and *Timminema* Khan, 1977. A key to the genera of the family Thornenematidae is provided.

The fifth paper on Nematodes from West Bengal (India) deals with genera related to *Thornenema* Andrássy, 1959 grouped in the family Thornenematidae Siddiqi, 1969. Many soil samples were collected in 1977 from Burdwan and 24 Parganas districts of West Bengal which yielded species of nematodes in the family Thornenematidae. For a better understanding of the group the type specimens of the following species were obtained: *Thornenema lissum* (Thorne, 1939) Andrássy, 1959; *T. wickeni* Yeates, 1970; *Sicaguttur sartum* Siddiqi, 1971; and *Willinema indicum* Baqri & Jairajpuri, 1967. Specimens of the following three species that were studied by Ali & Prabha (1974) were also available: five females of *Sicaguttur sartum* apud Ali & Prabha, 1974; four paratype females of *S. indicum* Ali & Prabha, 1974; and seven females and one male of *Indodorylaimus wickeni* Ali & Prabha, 1974.

Based on this material this paper provides an emended diagnosis of the genus *Sicaguttur* and its relationship with *Thornenema*; proposes a new genus *Jairajpuria*, a new genus *Mehdinema*[1]) for *Sicaguttur sartum* Ali & Prabha, 1974,

[1]) Names of subfamily and genus changed into Medalinematinae and *Medalinema*; see Note added in proof, p. 106.

S. indicum, and describes a new species; compares *Thornenema wickeni* and *Indodorylaimus wickeni*; emends the diagnosis of Thornenematidae; comments on the systematic position of *Willinema* Baqri & Jairajpuri, 1967; and proposes a new subfamily for *Mehdinema, Willinema, Indodorylaimus* Ali & Prabha, 1974 and *Timminema* Khan, 1977. A description of a new species of the genus *Sicaguttur* from Azamgarh, Uttar Pradesh is also included.

Geraert's (1961) formula is used for correcting the body-width measurements of flattened specimens.

Unless otherwise stated specimens are deposited in the National Collection of Zoological Survey of India, Calcutta, India.

GENUS *SICAGUTTUR* SIDDIQI, 1971

Siddiqi (1971) proposed a new genus *Sicaguttur* with a new species *S. sartum* having an amphidelphic female reproductive system like *Mesodorylaimus* Andrássy, 1959 whereas the lip region, basal expanded part of oesophagus, and the oesophageal gland nuclei and orifices were similar to *Thornenema*. In this respect *Sicaguttur* was reported as having features intermediate between *Thornenema* and *Mesodorylaimus*. Males of *Sicaguttur* were not found by Siddiqi (l.c.) who placed the genus in the family Thornenematidae.

Ali & Prabha (1974) added one more species of *Sicaguttur* (*S. indicum*) and also found males with long filiform tails like those of females of *S. sartum* and of their own species. They also proposed a subfamily Sicagutturinae under the family Prodorylaimidae Andrássy, 1969 to accommodate *Sicaguttur* and a closely related genus *Indodorylaimus*.

Our work based on five paratype females of *S. sartum* and two populations collected from West Bengal (India), described below, shows dissimilar tails in the sexes, and that the paratype females of *S. sartum* resembles in every respect the females of our populations. Specimens of *S. sartum* Ali & Prabha revealed that they differ from the type specimens of *S. sartum* as well as from the females of the West Bengal population in having differently shaped amphids (Fig. 1-D & E; Fig. 5-B; Fig. 5-L) and a disc between cardia and oesophagus (Fig. 1-I; Fig. 5-C; Fig. 5-M). The presence of endolids could not be confirmed in specimens studied by Ali & Prabha. Since the type specimens and the females from the West Bengal are morphologically similar and they jointly differ from Ali & Prabha's specimens in a number of characters, it is evident that Ali & Prabha (1974) have identified some other species as *S. sartum*.

Our study supports an amendment to the diagnosis of the genus *Sicaguttur*, and also its transfer to the subfamily Thornenematinae because of its affinities with *Thornenema* in having dissimilar tails in both the sexes.

Diagnosis (*emended*): Thornenematinae. Body medium sized (1-2 mm). Lip region with a heavily sclerotized framework, rounded, marked with a slight depression or continuous with body; hexagonal in *en face* view. Odontostyle cylindrical; aperture less than half of odontostyle length. Odontophore simple,

dorylaimid type. Basal expanded portion of oesophagus less than half the total oesophageal length; DO and DN located at short distance, S_1N_2 apart from S_1N_1, S_2N and S_2O located far from base of oesophagus. Female reproductive system didelphic. Vulva transverse, pre-equatorial. Female tail elongate-filiform. The male has non-contiguous ventromedian supplements and a short bluntly-conoid tail which is dissimilar to the tail of female.

Relationship: *Sicaguttur* shares all the morphological features with *Thornenema* except the didelphic reproductive system. The report of the abnormal development of anterior genital branch in two females of *Thornenema cavalcantii* (Lordello, 1955) Andrássy, 1959 by Baqri & Khera (1977), while describing the variations in this species (Fig. 2-H), suggests that the development of two reproductive branches (amphidelphic condition) may take place in some species of *Thornenema*. Moreover, species with mono-opisthodelphic reproductive system as well as with amphidelphic system are very commonly grouped under one genus of the superfamily Dorylaimoidea (de Man, 1876) Thorne, 1934. Basing genera on single or double genital branches is unjustified without other supporting characters. Because of the abnormality noted in *T. cavalcantii*, we may transfer *S. sartum* to *Thornenema*. But due to the complexity of the group and the difficulty of identifying females of different genera described hereafter, *Sicaguttur* is recognized as a valid genus on practical grounds to avoid confusion in this group.

Sicaguttur sartum Siddiqi, 1971
(Figs. 1, 2 & 5, K-M)

Measurements: Table I.

Description (based on West Bengal populations):

Female: As described by Siddiqi (1971). The values of oesophageal gland nuclei and their orifices (Diagram 1) have been calculated as follows: DO = 59.3-62.3; DN = 60.8-64.8; DO-DN = 1.0-2.5; S_1N_1 = 71-73; S_1N_2 = 75-77; S_2N = 84-86; S_2O = 86-88; K = 64-76; K′ = 70-76.

Male: Similar to female in general shape and morphology except in tail shape. Male genital system typical. Spicules 1.6 to 1.8 anal body-widths long when measured along the curved median line. Lateral guiding pieces rod-shaped. In addition to the adanal pair, seven to ten irregularly spaced ventromedian supplements; the first ventromedian supplement situated at 2.1 to 2.4 anal body-widths from cloacal opening. Subventral papillae spaced irregularly within the region of supplements. Copulatory muscles reaching up to the last supplement. Prerectum four to six anal body-widths long. Tail convex-conoid with bluntly rounded terminus, 0.6 to 0.8 anal body-width long; with three to five caudal pores on each side.

Habitat and localities: i) Narendrapur population: Soil around roots of pea, *Pisum sativum* L., from Narendrapur, district 24-Parganas, West Bengal, India; collected by Mr. C. A. Nageswara Rao in June, 1977. ii) Saldah popula-

TABLE I

Measurements and diagnostic features of Sicaguttur *species*

Species	*Sicaguttur sartum* Siddiqi 1971					*Sicaguttur longicaudatum* n. sp.	
	West Bengal populations,						
	Paratype	Narendrapur		Saldah		Holotype	Paratype
	4 (♀ ♀)	20 (♀ ♀)	9 (♂ ♂)	9 (♀ ♀)	6 (♂ ♂)	(♀)	2 (♀ ♀)
L	1.57-1.73	1.57-1.93	1.54-1.72	1.51-1.66	1.39-1.58	1.86	1.21-1.85
a	35-37	30-38	29-34	31-37	30-35	36	30
b	5.6-6.0	5.7-6.7	5.7-6.5	6.3-6.9	5.8-6.3	6.3	6.1
c	6-10	5.8-16.2	49-68	8.4-9.8	51.6-66.2	9	8-9
V/T	35-38	31-40	58-79	32-37	64-72	36	35-36
G_1	6.7-7.7	6-23	—	8.7-16.4	—	7	8
G_2	6.7-8.7	7-22	—	9.9-14.7	—	7	7
A	3.6-4.2	4.7-5.8	4.4-5.3	3.8-4.1	3.7-4.7	5	5-5.4
B	1.4-1.7	1.5-1.8	1.4-1.8	2.2-2.7	2-2.7	1.5	1.3-1.5
amphidial width (μm)	5-7	5-6	5-6	5-7	5-6	5	5
sensillar pouch (μm)	18	17-19	17-18	16-18	16-18	17	18
odontostyle (μm)	16-18	14-17	15-17	14-16	14-16	17	16-17
odontostyle aperture (μm)	5-6	5-6	5-6	4-5	4-5	5	5
odontophore (μm)	20-24	22-27	22-25	19-21	19-23	20	18-19
guiding ring (μm)	9-10	9-10	9-10	8-9	8-9	9	8-9
nerve ring (μm)	118-126	114-125	116-124	104-112	106-110	124	106-126
prerectum (μm)	50-58	50-90	160-191	56-69	114-157	58	56-66
rectum (μm)	32-41	31-39	—	28-32	—	27	23-26
anal body diameter (μm)	27-31	29-35	33-39	25-27	25-30	21	22-30
tail (μm)	167-286	97-279	23-32	169-184	24-29	211	159-225
vagina (μm)	17-22	19-25	—	21-22	—	17	16-19
spicule (μm)	—	—	54-62	—	44-47	—	—
lateral guiding piece (μm)	—	—	9-12	—	9-11	—	—
subventral papillae	—	—	5-6	—	5-6	—	—
ventromedian supplement	—	—	7-10	—	8-9	—	—
copulatory muscles	—	—	29-35	—	29-33	—	—
sperm (μm)	—	—	3-7	—	—	—	—

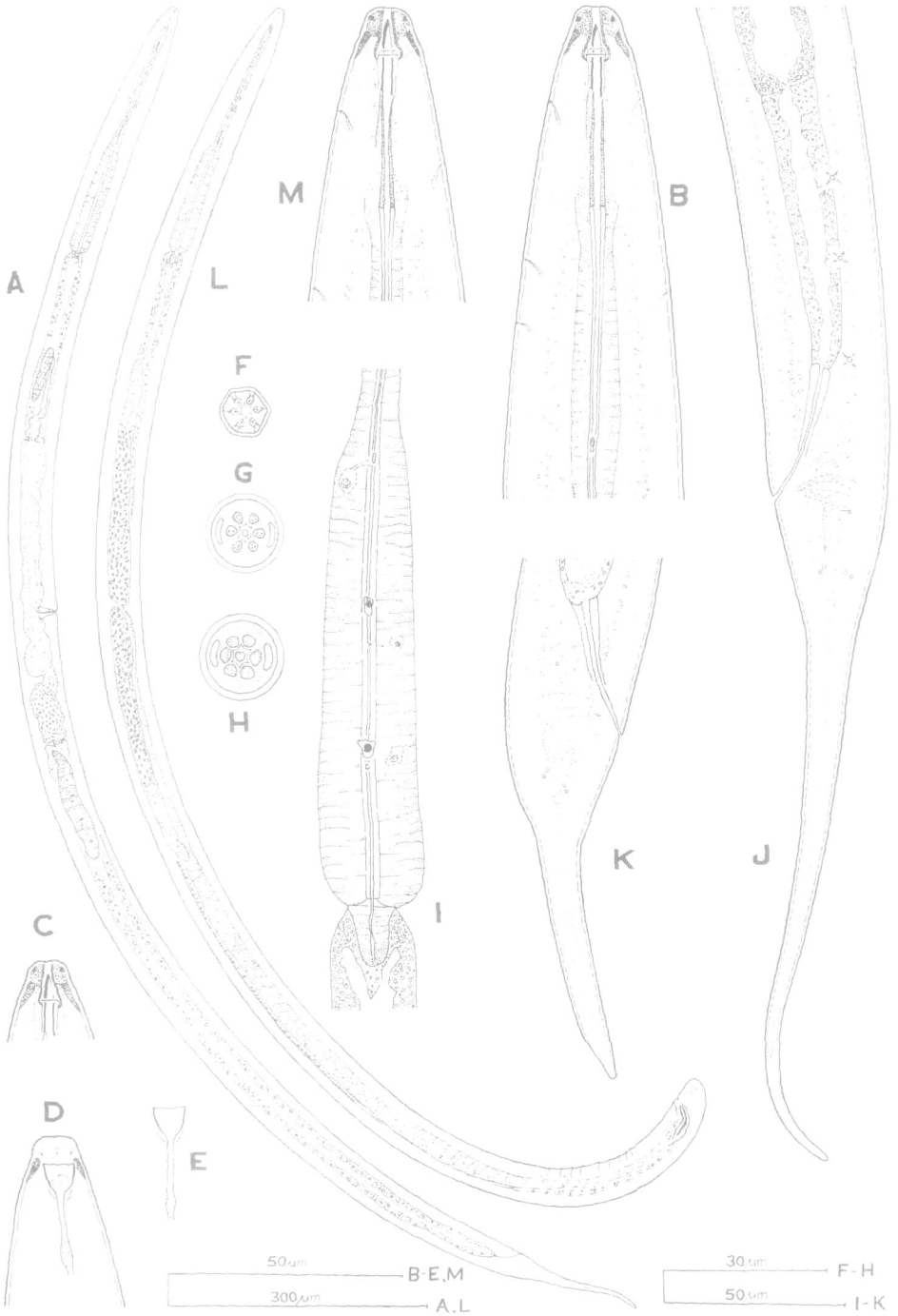

Fig. 1. *Sicaguttur sartum* Siddiqi, 1971; A-K: Female. A: Entire Female; B: Anterior region; C: Anterior end; D: Surface view of anterior end; E: Normal shape of amphid; F: *En face* view; G-H: Cross section of anterior end at amphidial level; I: Basal expanded portion of oesophagus; J: Posterior region; K: Tail with broken tip. L & M: Male. L: Entire male; M: Anterior region.

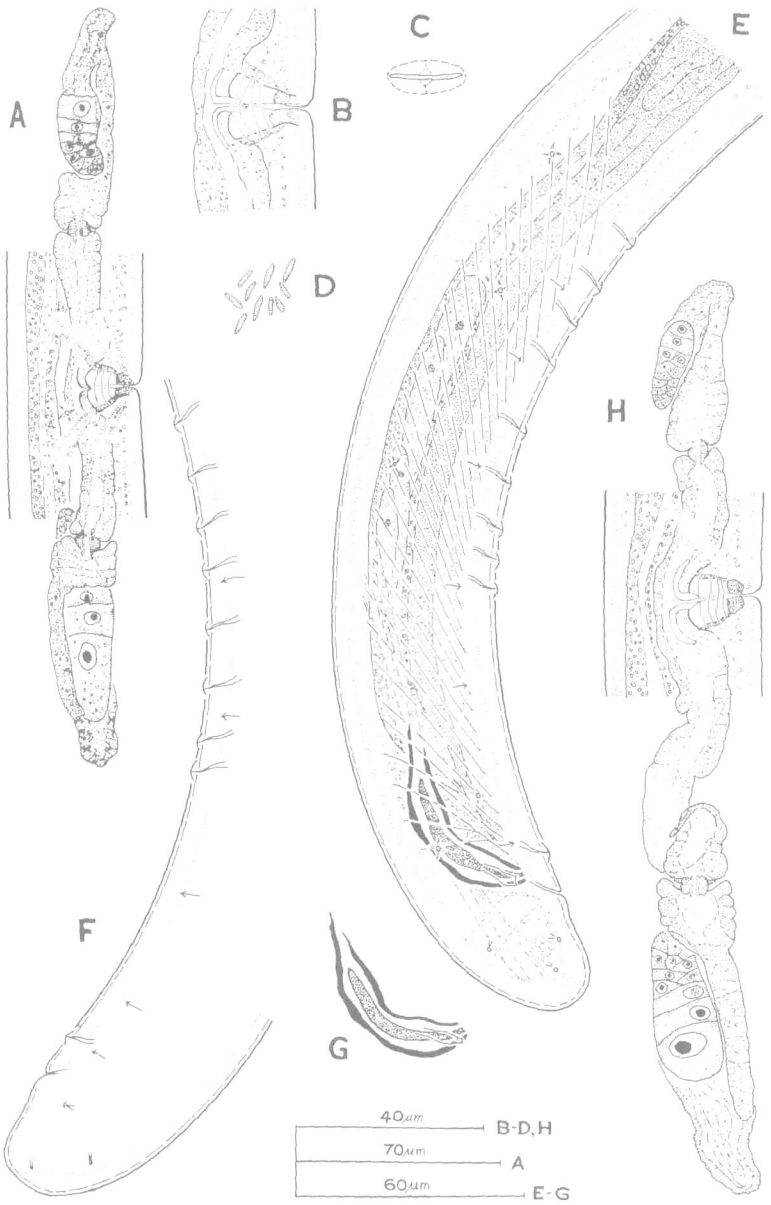

Fig. 2. A-G: *Sicaguttur sartum* Siddiqi, 1971. A: Female reproductive system; B: Vulva- vagina region; C: Vulva in dorso- ventral view; D: Sperms; E: Posterior body region of male; F: Variations in shape of male tail and the arrangement of ventromedian supplements; G: Spicules and lateral guiding pieces. H: Abnormal development of anterior sexual branch in *Thornenema cavalcantii* (Lordello, 1955) Andrássy, 1959.

tion: soil around roots of paddy, *Oryza sativa* L., from Saldah, district Burdwan, West Bengal; collected by the first author in December, 1977.

Remarks: The females of these populations resemble in every respect the paratype females of *S. sartum*. The cardiac appendage reported by Siddiqi could not be observed in paratype females.

Sicaguttus longicaudatum n. sp.
(Fig. 3)

Measurements: Table I.

Description:

Female: Body slightly curved ventrally when fixed; tapering gradually towards both ends. Cuticle with fine transverse striations, 2 to 5 μm thick (thickest on tail). Lateral chords about 1/8th of body-width near middle. Lateral body pores 50 in one female, of which nine were in the oesophageal region, 34 between cardia and prerectum, five in prerectum and rectum region, and two in caudal region. Ventral body pores eleven; dorsal body pores four.

Lip region heavily sclerotized, almost continuous, rounded. Amphids stirrup-shaped with slightly sclerotized walls, apertures occupying about 40% of the corresponding body-width. Odontostyle about 1.2 lip region-width long; aperture 26 to 29% of the odontostyle length. Guiding ring 0.7 to 0.8 lip region-width from anterior end. Odontophore 1.1 to 1.2 times the odontostyle length. Endolids 32% of the oesophageal length from anterior end. Nerve ring at 35 to 40% of the neck region from anterior extremity. Basal expanded part of oesophagus 42 to 45% of the total oesophageal length. Locations of oesophageal gland nuclei and their orifices (Diagram 4) as follows: DO = 60.7-62.3; DN = 61.9-63.5; DO-DN = 1.2; S_1O_1 = 72-74; S_1O_2 = 75-78; S_2N = 88; S_2O = 89-90; K = 70-73; K′ = 73-75.

Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum about two to three anal body-widths long. Rectum 0.8 to 1.3 anal body-width long.

Vulva a transverse slit. Vagina extending about 1/3rd of the corresponding body-width, sclerotized at distal end. Female reproductive system amphidelphic. Uterus and oviduct separated by a sphincter. Sperm not seen. Oocytes arranged in a single row except in growth region.

Tail long filiform, 7.5 to 10.0 anal body-widths long; with two caudal pores on each side.

Male: Not found.

Type habitat and locality: Soil around roots of bitter gourd, *Momordica charantia* L., from Azamgarh, Uttar Pradesh, India.

Type specimens: Holotype mounted on slide WN/291, paratypes on slide WN/292; collected by Dr. M. S. Jairajpuri in June, 1966.

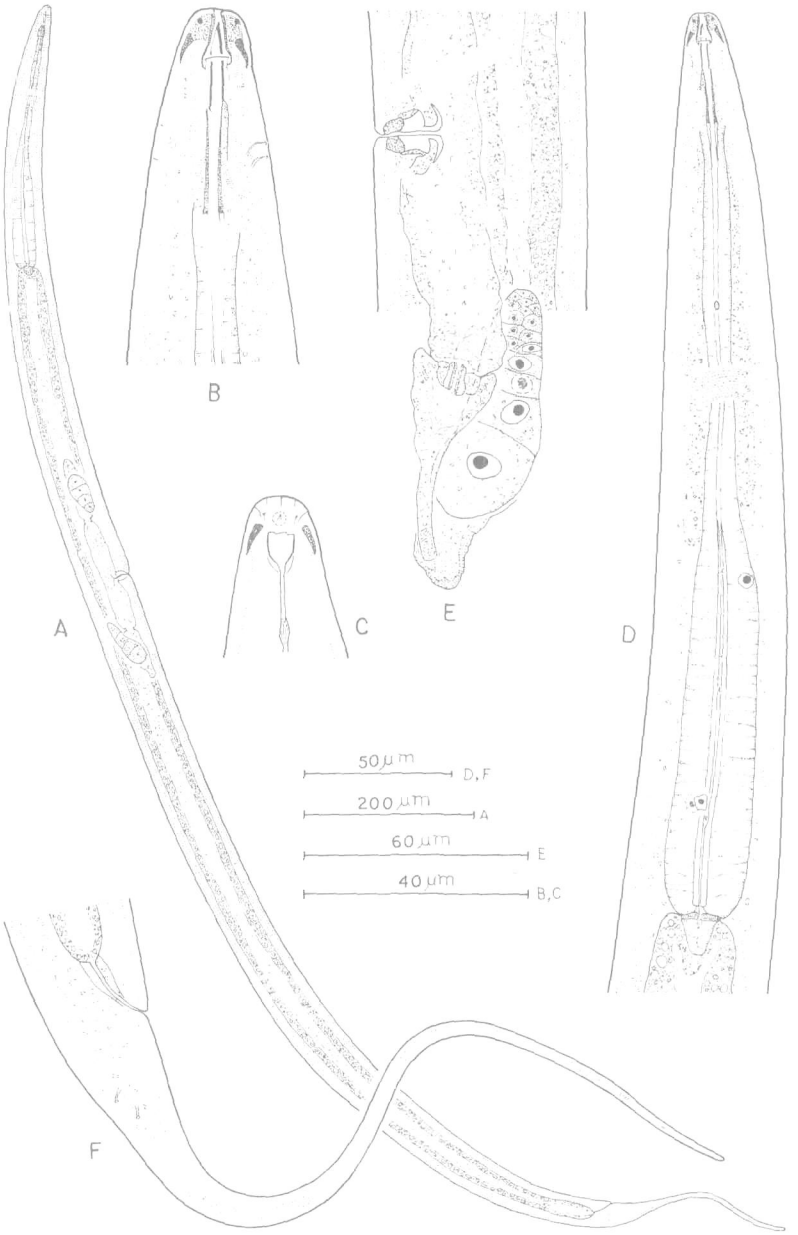

Fig. 3. *Sicaguttur longicaudatum* n. sp. A: Entire female; B: Anterior end; C: Surface view of anterior end; D: Oesophageal region; E: Posterior sexual branch; F: Tail.

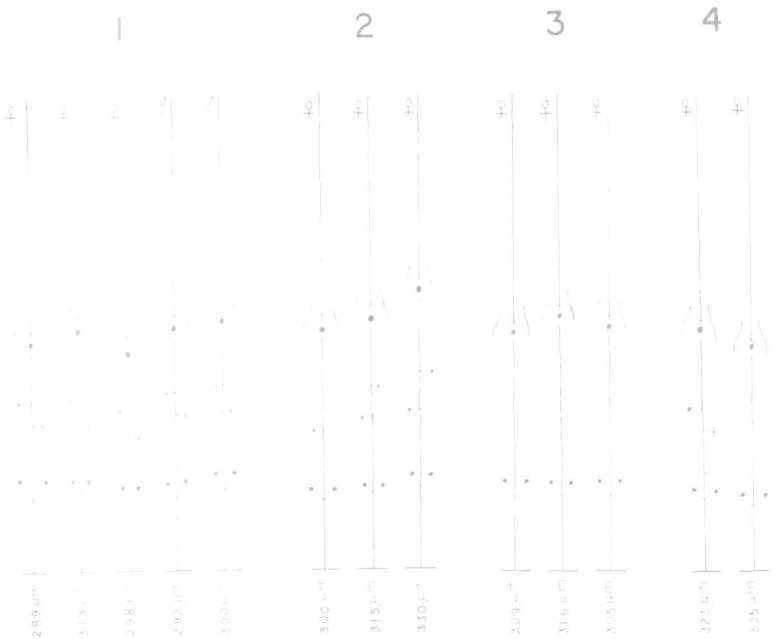

Diagram 1-4: Locations of Oesophageal gland nuclei and their orifices. 1: *Sicaguttur sartum* Siddiqi, 1971. 2: *Mehdinema prabhae* n. gen. n. sp. 3: *Mehdinema indicum* (Ali and Prabha, 1974) n. comb. 4: *Sicaguttur longicaudatum* n. sp.

Differential diagnosis: *Sicaguttur longicaudatum* n.sp., differs from *S. sartum* Siddiqi, 1971 in having a continuous lip region (lip region marked by a depression in *S. sartum*), differently shaped amphids, a small disc at oesophago-intestinal junction, and a differently shaped vagina.

Remarks: In having oesophago-intestinal disc, these specimens come close to *S. sartum* Ali & Prabha 1974. Since the males have not been found in this population, this species has been placed under *Sicaguttur* until the males are known.

GENUS *JAIRAJPURIA* N. GEN.

Diagnosis: Thornenematinae. Body less than 1 mm. Lip region sclerotized off-set and cap-like; hexagonal in *en face* view. Amphids closely situated to lateral lips. Odontostyle cylindrical; aperture less than half of its own length. Odontophore simple, dorylaimid type. Basal expanded part of oesophagus less than half of the total oesophageal length; DO-DN located at short distance, S_1N_2 apart from S_1N_1, S_2O located far from base of oesophagus (about 90% from anterior end), and S_2O and S_2N located comparatively far from each other (distance about 4%). Vulva transverse, pre-equatorial. Female with mono-opisthodelphic reproductive system; anterior uterine sac about one vulva body-width. Males with non-contiguous ventromedian supplements.

Tails dissimilar in both the sexes, elongate conoid in female and short bluntly-conoid in male.

Type and only species: *Jairajpuria shamimi* n.sp.

Relationship: The new genus *Jairajpuria* differs from *Thornenema* in having offset and cap-like lip region (lip region continuous or demarcated by a slight depression in *Thornenema*); amphids closely situated to lateral lips (amphids situated at short distance from lateral lips in *Thornenema*); distance between S_2N and S_2O is about 4% (distance between S_2N and S_2O is about 2% in *Thornenema*); and a much longer uterine sac (uterine sac less than one corresponding body-width long in *Thornenema*).

*Jairajpuria shamimi** n.gen., n.sp.
(Fig. 4)

Measurements: Table II.

Description:

Female: Body slightly curved ventrally when fixed; tapering gradually towards both ends. Cuticle with fine transverse striations, 1 to 2 μm thick (thickest on tail). Lateral, dorsal and ventral body pores not visible. Lateral chords about 1/6th to 1/4th of body-width near middle.

Lip region sclerotized, off-set by a constriction, slightly wider than adjoining body, cap-like. Amphids stirrup-shaped, apertures occupying 55 to 67% of the corresponding body-width. Odontostyle 1.3 to 1.6 lip region-width long; aperture 20 to 33% of odontostyle length. Guiding ring 0.7 to 1.0 lip region-width from anterior end. Odontophore 1.3 to 1.5 times the odontostyle length. Nerve ring 46 to 54% of the neck region from anterior end. Basal expanded part of oesophagus 33 to 37% of the total oesophageal length. Locations of oesophageal gland nuclei and their orifices (Diagram 6) as follows: DO = 67.0-68.9; DN = 69.6-71.5; DO-DN = 2.5-2.6; S_1N_1 = 76-79; S_1N_2 = 78-80; S_2N = 85-87; S_2O = 89-91; K = 66-77; K′ = 73-88.

Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum about 2.2 to 3.8 anal body-widths long. Rectum 1.0 to 1.5 anal body-width long.

Vulva a transverse slit. Vagina 1/3 to 2/5 of the corresponding body-width; sclerotized distally. Female reproductive system mono-opisthodelphic. Anterior uterine sac 0.8 to 1.2 of the corresponding body-width. Posterior sexual branch typical. Uterus and oviduct separated by a well developed sphincter. Oocytes arranged in a single row except at anterior tip.

Tail elongate-conoid, tapering gradually to a rounded terminus, 3.7 to 4.6 anal body-widths long (2.5 anal body-widths long in an abnormal female, Fig. 4-K), with one to two caudal pores on each side.

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* The new genus and new species is named after Dr. M. Shamim Jairajpuri.

TABLE II

Measurements and diagnostic features of Jairajpuria shamimi *n. gen., n. sp.*

	Abujhati population (type)			Manirambati population	
	Holotype (♀)	Paratype 9 (♀♀)	Paratype 8 (♂♂)	4 (♀♀)	4 (♂♂)
L	0.66	0.64-0.72	0.62-0.66	0.73-0.77	0.69-0.76
a	27	24-29	25-27	29-31	30-31
b	4.7	4.4-5.0	4.4-4.9	4.9-5.1	4.7-5.5
c	11	10-18	27-33	11-12	32-38
V/T	46	44-50	46-63	45-48	56-60
G_1	3.7	2.8-4.1	—	2.6-2.9	—
G_2	22	15-22	—	14-15	—
A	3.4	3.1-3.7	3.1-3.3	2.9-3.2	3.0-3.2
B	2.6	2.0-2.6	1.7-2.1	1.8-2.1	1.9-2.1
amphidial width (μm)	4	4-5	4-5	4-5	4-5
sensillar pouch (μm)	16	15-17	15-17	15-17	15-17
odontostyle (μm)	10	9-11	9-11	10-11	10-11
odontostyle aperture (μm)	2	2-3	2-3	2-3	2-3
odontophore (μm)	15	14-15	14-15	14-15	14-15
guiding ring (μm)	6	6-7	6-7	6	6
nerve ring (μm)	66	64-70	62-74	69-72	67-75
prerectum (μm)	66	42-58	69-125	37-48	70-72
rectum (μm)	19	19-21	—	19-22	—
anal body diameter (μm)	16	14-15	16-18	16-17	16-17
tail (μm)	59	37-69	20-23	64-71	20-22
vagina (μm)	9	9-11	—	10-11	—
spicule (μm)	—	—	20-23	—	22-24
lateral guiding piece (μm)	—	—	3-4	—	3-5
ventromedian supplement	—	—	3-4	—	3-4
copulatory muscles	—	—	14-19	—	15-18
sperm (μm)	—	—	2-4	—	3-4

Male: Similar to female in general shape and morphology except the short conoid tail and the male genital system. Male genital system typical. Spicules 1.0 to 1.3 anal body-width long when measured along the curved median line. Lateral guiding pieces rod-shaped, poorly developed. In addition to the adanal pair, three to four irregularly spaced ventromedian supplements; the first ventromedian supplement at 2.2 to 2.8 anal body-widths from cloacal opening. Subventral papillae not seen. Copulatory muscles reaching up to the last supplement. Prerectum 4.3 to 5.5 anal body-widths long, in one male 7.7 anal body-widths long. Tail dissimilar to female, 1.2 to 1.3 anal body-width long, short bluntly-conoid, with two caudal pores on each side.

Type habitat and locality: Abujhati population (type): soil around roots of paddy, *Oryza sativa* L., from Abujhati, Jamalpur Block, district Burdwan, West Bengal, India; collected by the first author in December, 1977. Manirambati population: soil around roots of paddy, *O. sativa* L., from Manirambati, Jamalpur Block, district Burdwan.

Type specimens: Holotype along with 4 paratype females mounted on slide

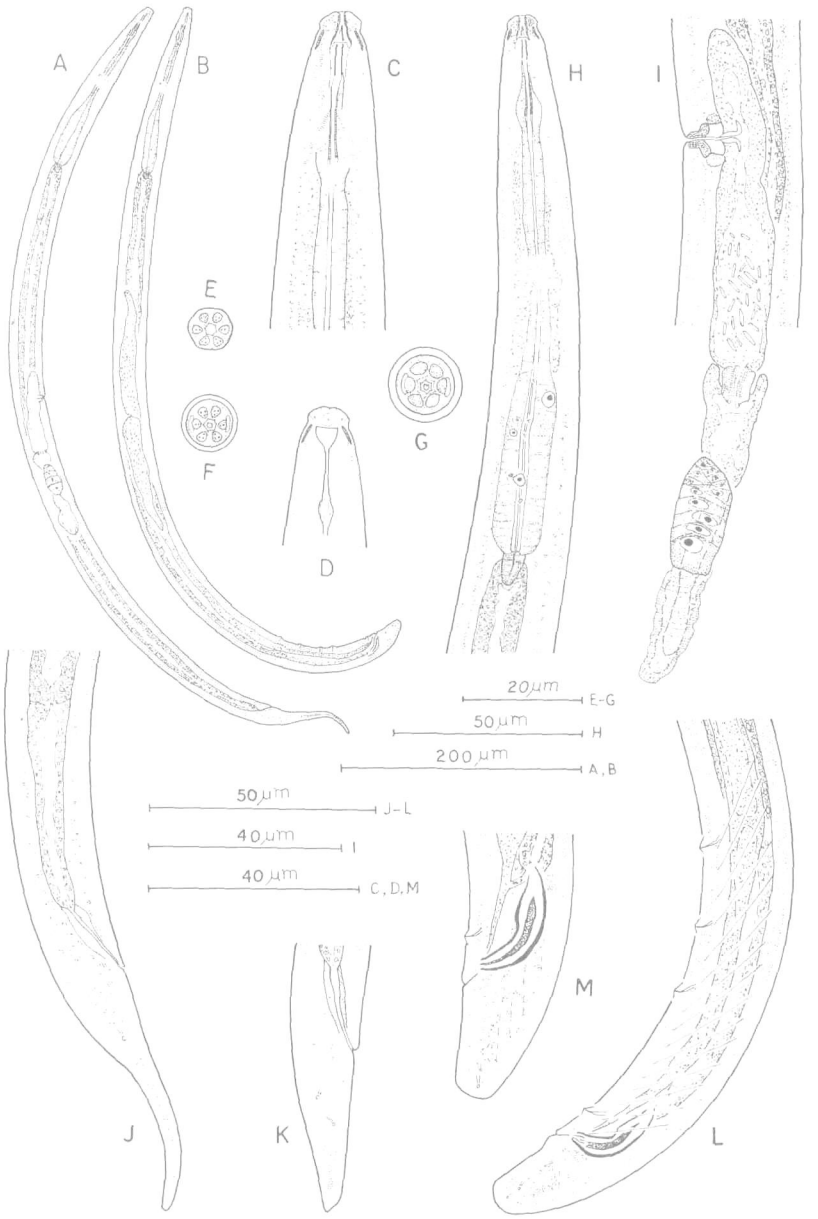

Fig. 4. *Jairajpuria shamimi* n. gen., n. sp. A: Entire female; B: Entire male; C: Anterior region; D: Surface view of anterior end; E: *En face* view; F & G: Cross section of anterior end at amphidial level; H: Oesophageal region I: Female reproductive system; J: Posterior region of female; K: Abnormal tail of female; L: Posterior region of male; M: Posterior end of male.

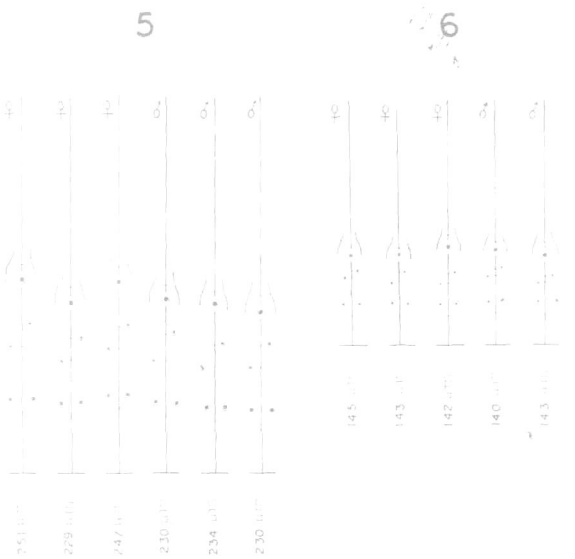

Diagram 5-6. Locations of oesophageal gland nuclei and their orifices. 5: *Medhinema coomansi* n. sp. 6: *Jairajpuria shamimi* n. gen. n. sp.

WN/293; other paratype females and males on slide WN/294. Specimens from Manirambati mounted on slide WN/295. A slide T-2409p containing males and females from Manirambati population has been deposited in the USDA Nematode Collection, Beltsville, Maryland 20705.

GENUS *MEHDINEMA*[1]) N.GEN.

Sicaguttur sartum has dissimilar tails in the two sexes and the species identified and reported by Ali & Prabha (1974) as *S. sartum* having similar tails in the sexes obviously does not belong to the genus *Sicaguttur* but represents a new genus. Hence the genus *Mehdinema* n.gen., after Prof. Syed Mehdi Ali, is proposed for *S. sartum* Ali & Prabha, 1974 and also for its closely related species *S. indicum* Ali & Prabha, 1974. This new genus is placed under the new subfamily Mehdinematinae[1]).

Diagnosis: Mehdinematinae[1]) n. subfam. Medium sized (1 to 2 mm long). Lip region with a heavily sclerotized framework, rounded, demarcated by a slight depression or continuous with body; hexagonal in *en face* view. Odontostyle cylindrical; aperture less than half of its own length. Odontophore simple, dorylaimid type. Basal expanded portion of oesophagus less than half of the total oesophageal length; DO and DN located at short distance, S_1 N_2 apart from S_1N_1, S_2N and S_2O located far from base of oesophagus. Female reproductive system didelphic. Vulva transverse, pre-equatorial. Supplements consist of an adanal pair and non-contiguous ventromedian supplements, the

[1]) See Note on p. 106.

first ventromedian supplement outside the range of spicules. Tail in both sexes similar, elongate-conoid with a filiform terminus.

Type species: *Mehdinema*[1]) *prabhae* n.sp.
Syn. *Sicaguttur sartum* Ali & Prabha, 1974
Nec *Sicaguttur sartum* Siddiqi, 1971

Other species: *Mehdinema*[1]) *indicum* (Ali & Prabha, 1974) n. comb.
Mehdinema[1]) *coomansi* n. sp.

Relationship: *Mehdinema*[1]) n. gen. differs from *Indodorylaimus* Ali & Prabha, 1974 in having didelphic reproductive system in female and the first pair of ventromedian supllements outside the range of spicules in male (female reproductive system mono-opisthodelphic and first pair of ventromedian supplements within the range of spicules in *Indodorylaimus*).

Mehdinema[1]) *prabhae** n.sp.
(Fig. 5, A-E)

Measurements: Table III.

Description:

Female: Body slightly ventrally curved when fixed, tapering slightly towards both ends. Cuticle with fine transverse striations, 2 to 7 μm thick (thickest on tail). Lateral body pores 46 to 49 out of which eight to nine in oesophageal region, 29 to 32 between cardia and prerectum, four to six in prerectum and rectum region, and three to four in caudal region. Ventral body pores 18 to 24; dorsal body pores three to four.

Lip region heavily sclerotized, demarcated by a slight depression. Amphids stirrup-shaped, walls slightly sclerotized; apertures occupying 55 to 64% of the corresponding body-width. Odontostyle 1.5 to 1.7 lip region-width; aperture 24 to 29% of odontostyle length. Guiding ring 0.9 to 1.0 lip region-width from anterior end. Odontophore 1.2 to 1.3 times the odontostyle length. Endolids not present. Basal expanded part of oesophagus 43 to 45% of the total oesophageal length. Locations of oesophageal gland nuclei and their orifices (Diagram 2) as follows: DO = 59.1-60.7; DN = 60.5-62.2; DO-DN = 1.4-2.1; S_1N_1 = 72-73; S_1N_2 = 76-79; S_2N = 85-86; S_2O = 88-89; K = 69-70; K′ = 71-74.

Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc well developed (Fig. 5, C). Prerectum 1.6 to 2.0 anal body-widths long. Rectum about one anal body-width long.

Vulva a transverse slit. Vagina extending about half of the corresponding body-width, sclerotized distally, not encircled by sphincter muscles. Female

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[1]) See note on p. 106.

*) The species has been named after Miss M. J. Prabha.

TABLE III

Measurements and diagnostic features of Mehdinema *species*

Species	*Mehdinema coomansi* n. sp.			*Mehdinema prabhae* n. gen., n. sp.		*Mehdinema indicum* (Ali & Prabha, 1974) n. comb.
	Holotype (♀)	Paratype 22 (♀♀)	Paratype 14 (♂♂)	Lectotype (♀)	Paralectotype 5 (♀♀)	Paratype 4 (♀♀)
L	1.41	1.29-1.65	1.35-1.47	1.64	1.74-1.84	1.82-1.86
a	31	31-40	31-39	37	39-43	37-42
b	5.9	5.6-6.7	6.0-6.5	5.2	5.6-6.0	5.9-6.3
c	9.6	9-12	10-12	5.6	5.7-9.1	8.9-9.8
V/T	40	37-44	55-64	42	37-41	37-39
G_1	10	8.5-12.0	—	7	6.4-6.8	7.4-7.9
G_2	15	10-16	—	6.9	6.2-6.5	6.0-7.8
A	3.9	3.2-4.2	3.3-3.6	3.8	3.6-3.9	4.2-4.8
B	2.2	2.0-2.2	1.7-2.2	1.8	1.6-1.8	1.3-1.4
amphidial width (μm)	7	6-7	6-7	7	6-7	5-7
sensillar pouch (μm)	17	16-18	16-18	16	15-17	16
odontostyle (μm)	12	12-15	13-15	17	16-17	16-17
odontostyle aperture (μm)	4	4-5	4-5	4	4-5	4
odontophore (μm)	18	18-21	18-21	22	20-23	19-21
guiding ring (μm)	7	6.5-7.5	7-8	11	10-11	10-11
nerve ring (μm)	112	90-112	98-110	120	120-127	122-128
prerectum (μm)	61	54-75	101-135	61	66-72	47-84
rectum (μm)	27	23-28	—	37	35-40	34-40
anal body diameter (μm)	24	21-27	24-27	37	34-39	35-37
tail (μm)	146	122-165	112-132	292	188-302	186-206
vagina (μm)	16	13-18	—	21	18-25	22-29
spicule (μm)	—	—	33-38	—	—	—
lateral guiding piece (μm)	—	—	7-8	—	—	—
ventromedian supplement	—	—	7-9	—	—	—
copulatory muscles	—	—	20-28	—	—	—
sperm (μm)	—	—	3-4	—	—	—

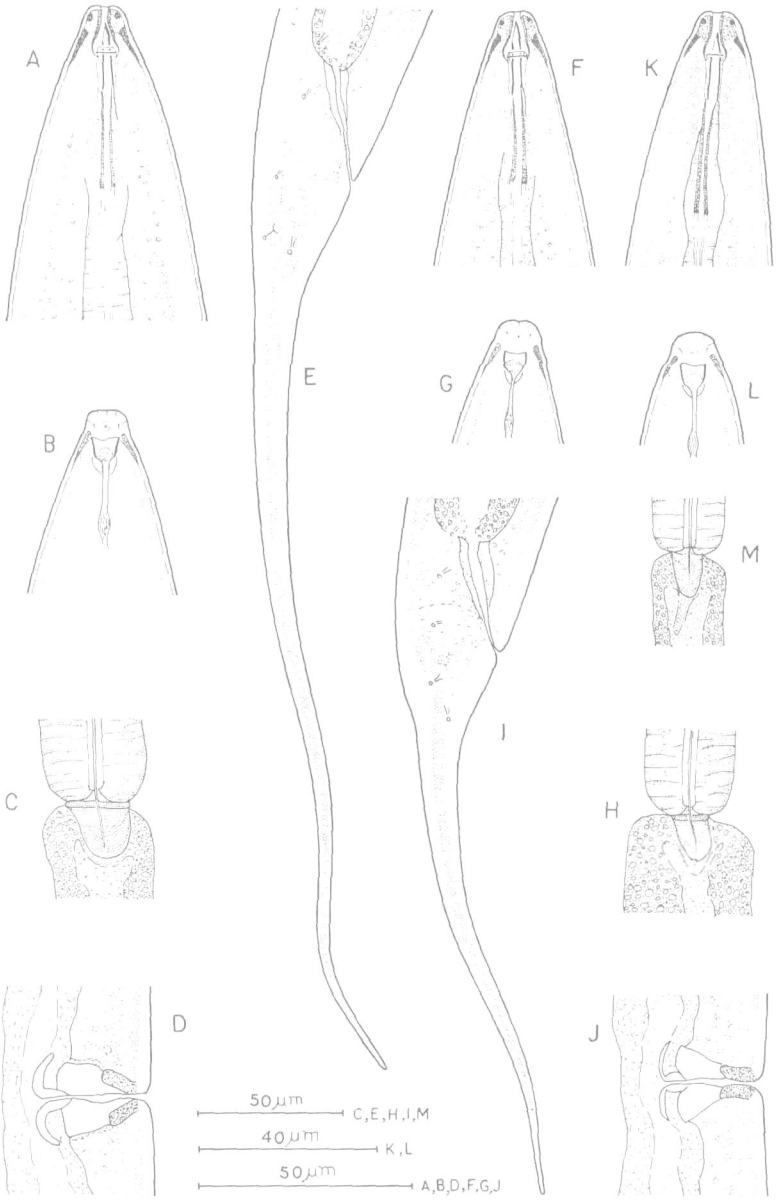

Fig. 5. *A-E: Mehdinema prabhae* n. gen., n. sp. A: Anterior end; B: Surface view of anterior end; C: Oesophago-intestinal junction; D: Vulva-vagina region; E: Female tail. F-J: *Mehdinema indicum* (Ali and Prabha, 1974) n. comb. F: Anterior end; G: Surface view of anterior end; H: Oesophago-intestinal junction; I: Female tail. J: Vulva-vagina region; K-M: *Sicaguttur sartum* Siddiqi 1971 (Paratype female). K: Anterior end; L: Surface view of anterior end; M: Oesophago-intestinal junction.

reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Oocytes arranged in a single row except at growth region.

Tail long filiform, eight to nine anal body-widths long with three to four caudal pores on each side.

Male: Not available.

Type habitat and locality: From soil around roots of tomato, *Lycopersicon esculentum* Mill., from Pankanhergaon, district Parbhani, Maharshtra, India; collected by S. M. Ali & M. J. Prabha.

Type specimens: Ali & Prabha (1974) deposited specimens of their *S. sartum* in the Museum of Zoology Department, Marathwada University, Aurangabad, Maharashtra, India, but despite requests the specimens were not made available. However, five females on slide No. PMJ/117/1.2 were deposited in the Museum voor Dierkunde, Rijksuniversiteit, Gent, Belgium. These specimens were obtained, designated lectotype and paralectotypes and returned.

Mehdinema indicum (Ali & Prabha, 1974) n. comb.
(Fig. 5, F-J)

Measurements: Table III.

Four females of *S. indicum* on slide PMJ/107/1.4 were also deposited in the Museum voor Dierkunde, Rijksuniversiteit, Gent, Belgium. Measurements in Table III are based on these. The positions of oesophageal gland nuclei and their orifices were seen (Diagram 3) as follows: DO = 60.2-61.8; DN = 61.6-63.3 DO-DN = 1.4-1.5; S_1N_1 = 73-74; S_1N_2 = 77-78; S_2N = 86-88; S_2O = 88-89; K = 72-79; K′ = 75-81.

All the measurements are almost same as of Ali & Prabha in the original description except the length of prerectum which was 54 to 90 μm whereas it was reported 30 to 53 μm long.

Remarks: According to Ali & Prabha (1974) the females of *S. indicum* (now *M. indicum*) differ from their *S. sartum* (now *M. prabhae*) only in having a distinct constriction in tail region before it becomes a filiform terminus, and in the tail being five to six anal body-widths long against ten to eleven times in the latter species. The males of *M. indicum* and *M. prabhae* which were not obtained were distinguished by Ali & Prabha (1974) as follows: Six ventromedian supplements and spicules 42 to 43 μm long in *M. indicum* against nine supplements and 48 to 49 μm long in *M. prabhae*.

*Mehdinema coomansi** n.sp.
(Fig. 6)

Measurements: Table III.

Description:

Female: Body slightly curved ventrally upon fixation, tapering gradually towards both ends. Cuticle with fine transverse striations, 2 to 6 μm thick

* The new species is named after Prof. Dr. A. Coomans.

(thickest on tail). Lateral chords 1/5th to 1/3rd of body-width near middle. Lateral, ventral and dorsal body pores not visible.

Lip region slightly narrower than adjoining body, demarcated by a slight depression, cheilostome moderately sclerotized, with amalgamated lips bearing the usual number of papillae; hexagonal in *en face* view. Amphids stirrup-shaped, apertures occupying 48 to 63% of the corresponding body-width. Odontostyle 1.0 to 1.4 lip region-width; aperture 27 to 33% of odontostyle length. Guiding ring 0.6 to 0.7 lip region-width from anterior end. Odontophore 1.1 to 1.5 times the odontostyle length. Endolids 32 to 35% of the oesophageal length from anterior end. Nerve ring 39 to 46% of the neck region from anterior extremity. Basal expanded part of oesophagus 37 to 43% of the total oesophageal length. Locations of the oesophageal gland nuclei and their orifices (Diagram 5) as follows: DO = 61.3-64.5; DN = 64.0-66.8; DO-DN = 2.3-3.2; S_1N_1 = 71-75; S_1N_2 = 75-79; S_2N = 83-87; S_2O = 86-90; K = 57-68; K′ = 66-74.

Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum about two to four anal body-widths long. Rectum about one anal body-width long.

Vulva a transverse slit. Vagina about 1/3 to 1/2 of corresponding body-width, moderately sclerotized at vulva-vagina junction. Female reproductive system amphidelphic, but the oviduct and ovary of the anterior sexual branch are always poorly developed (Fig. 6-I). Uterus and oviduct separated by sphincter. Sperm present in uteri and oviducts.

Tail elongate, tapering gradually to a narrow rounded tip, five to seven anal body-widths long; with two caudal pores on each side.

Male: Similar to female in general shape and morphology. Male genital system typical. Spicules 1.3 to 1.5 anal body-width long. Lateral guiding pieces well developed, rod-shaped. In addition to the adanal pair of supplement, seven to nine regularly spaced ventromedian supplements present; the first ventromedian supplement situated at 2.3 to 2.7 anal body-widths from cloacal opening. Subventral papillae not seen. Copulatory muscles reaching up to the last supplement. Prerectum four to six anal body-widths long, restricted in the supplement region except in one specimen. Tail similar to female, 4.7 to 5.2 anal body-widths long; with one to two caudal pores on each side.

Type habitat and locality: Soil around roots of paddy, *Oryza sativa* L., from Radhakantapur, Memari Block, district Burdwan, West Bengal, India; collected by the first author in December, 1977.

Type specimens: Holotype female along with four paratype females and four paratype males mounted on slide WN/296; other paratypes on slides WN/297-301.

Differential diagnosis: Mehdinema coomansi n.sp. differs from *M. prabhae* n.sp. and *M. indicum* (Ali & Prabha, 1974) n. comb. jointly in having only sclerotized cheilostome in lip region, differently shaped amphids, anteriorly situated

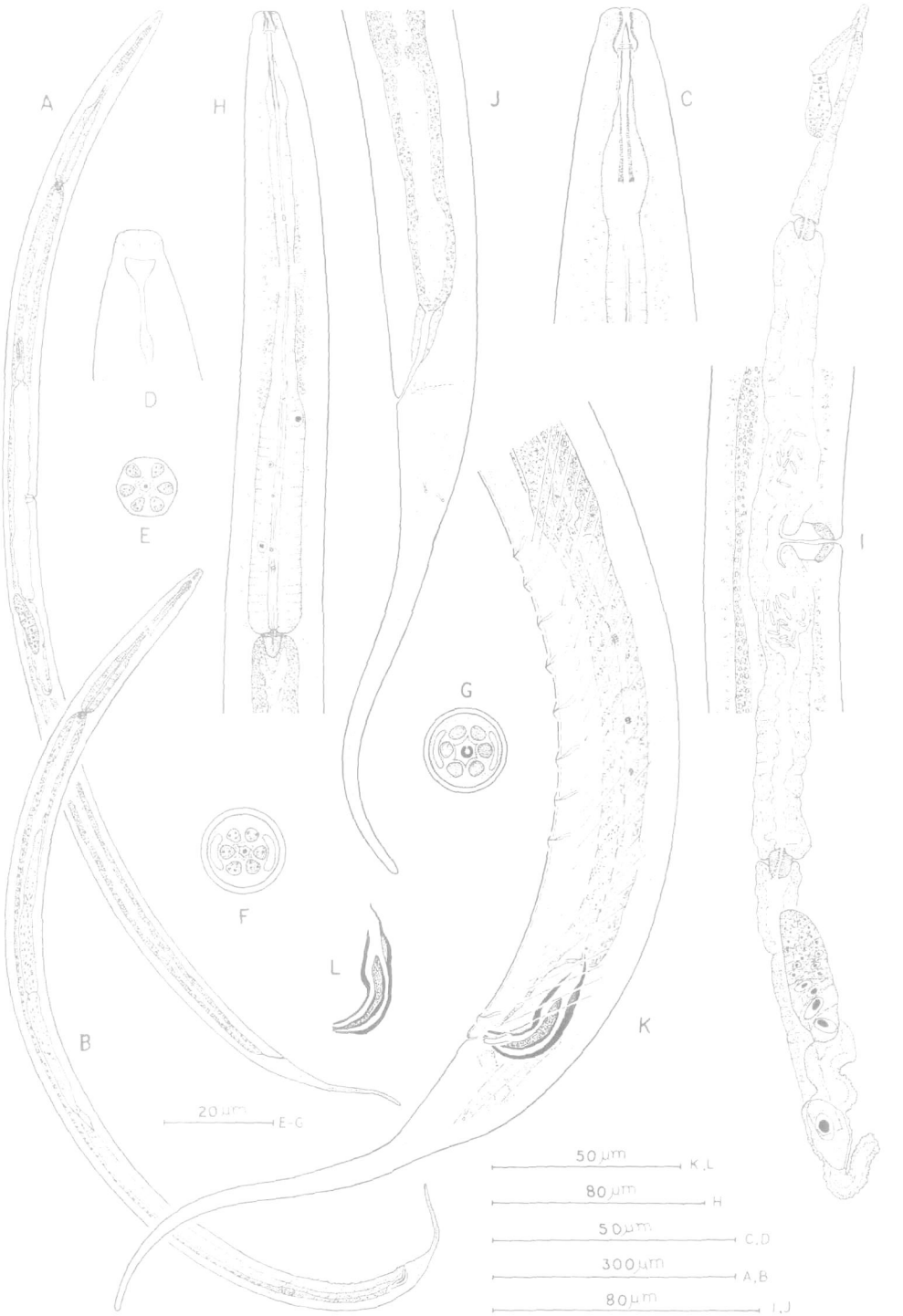

Fig. 6. *Mehdinema coomansi* n. sp. A: Entire female; B: Entire male; C: Anterior end; D: Surface view of anterior end; E: *En face* view; F & G: Cross section of anterior end at amphidial level; H: Oesophageal region; I: female reproductive system; J: Posterior region; K: Posterior region of male; L: Spicule.

guiding ring, oviduct and ovary of anterior sexual branch poorly developed and differently shaped spicules (lip region heavily sclerotized, the walls of amphidial pouch sclerotized, guiding ring 9 to 11 μm from anterior end, and well developed oviduct and ovary in anterior sexual branch in *M. prabhae* and *M. indicum*).

Remarks: Though *Mehdinema coomansi* n.sp. is distinct from the other two species of the genus in having less sclerotized lip region and poorly developed oviduct and ovary in anterior sexual branch, it is well placed in this genus because of other similarities.

GENUS *INDODORYLAIMUS* ALI & PRABHA, 1974

Ali & Prabha (1974) found males of *Thornenema wickeni* Yeates, 1970 having tails similar to those of females. Since the male and female tails are dissimilar in *Thornenema*, a new genus *Indodorylaimus* was established by them to accommodate *T. wickeni*. *Indodorylaimus* was distinguished from *Sicaguttur* on the basis of the population identified as *S. sartum*, in having mono-opisthodelphic reproductive system in female and the first ventromedian supplement within the range of spicules in male.

Comparison of type specimens of *T. wickeni* and the Indian population for which the *Indodorylaimus* was proposed by Ali & Prabha (1974) reveals that the type specimens differs from the Indian specimens in body measurements (shorter body; odontostyle 10 to 12 μm against 12 to 14 μm; odontophore 12 to 15 μm against 18 to 20 μm etc.) and also in the following characters: The narrower and less sclerotized lip region (Fig. 7, B-Paratype female, G & H-Indian specimen), differently shaped amphids (Fig. 7, C- Paratype, H & I-Indian specimen), finely striated cuticle in type specimens against coarsely striated in Indian specimens, less muscular basal expanded part of oesophagus in type specimen against highly muscular in Indian specimens, and differently shaped vulva and vagina (Fig. 7, E- Paratype, K- Indian specimen). It is, therefore, evident that Ali & Prabha misidentified their specimens as *T. wickeni*.

After examining one paratype female of the type species of *Thornenema*, *T. lissum* (Thorne, 1939) Andrássy, 1959 (Fig. 7, A), we conclude that *T. wickeni* is well placed in the genus *Thornenema*.

Since the designated type species (*I. wickeni*) is misidentified, the International Commision on Zoological Nomenclature has been requested to use its plenary powers (Art 70, a, i) to declare *I. wickeni* as a *nomen nudum*.

Though *Mehdinema* and *Indodorylaimus* have common morphological features except that the latter has a mono-opisthodelphic female reproductive system and the first ventromedian supplement within the range of spicules in males. However, to avoid the heterogeneous nature of the genera in the family Thornenematidae, we recognize the genus *Indodorylaimus* under Mehdinematinae n. subfam.

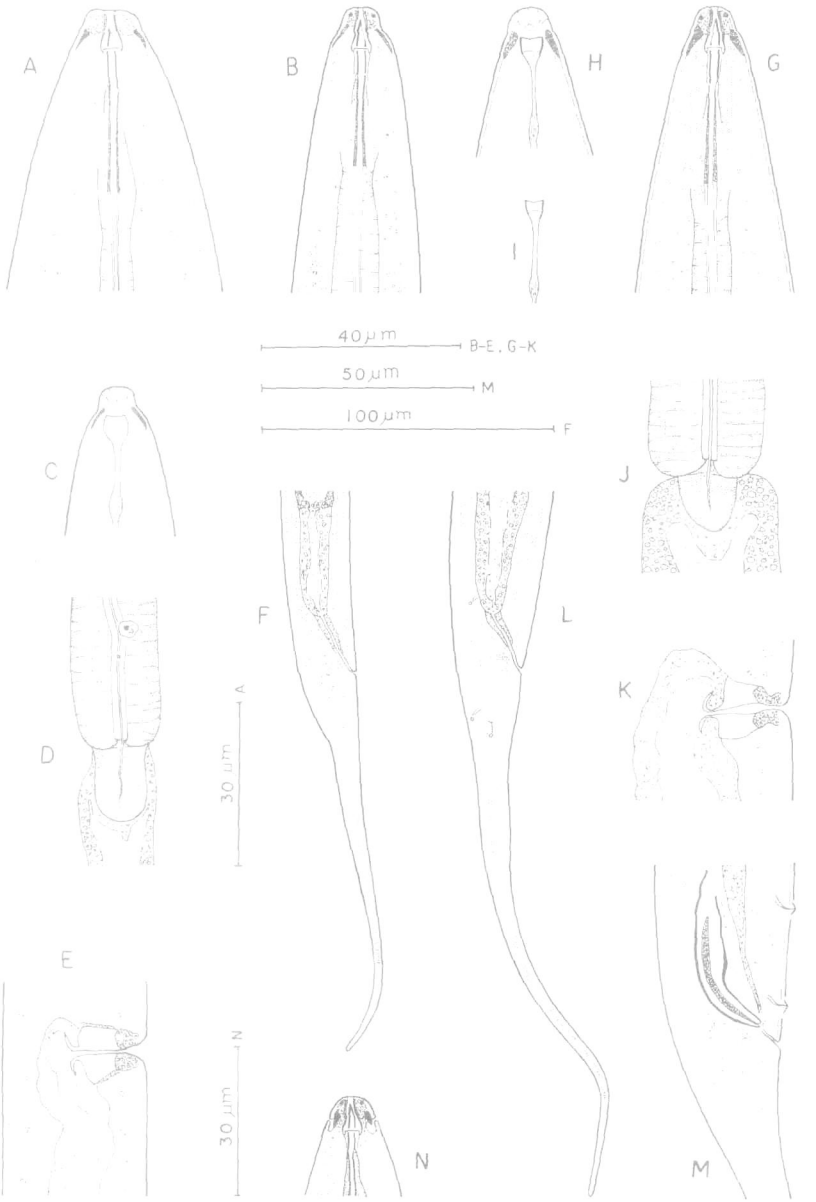

Fig. 7. A: *Thornenema lissum* (Thorne, 1939) Andrássy, 1959, anterior end of female paratype. B-F: *Thornenema wickeni* Yeates, 1970 (Paratype female). B: Anterior end; C: Surface view of anterior end; D: Oesophago-intestinal junction; E: Vulva-vagina region; F: Posterior end. G-M: Ali & Prabha's misidentified *wickeni*. G: Anterior end; H: Surface view of anterior end; I: Amphid; J: Oesophago-intestinal junction; K: Vulva-vagina junction; L: Posterior end; M: Spicule region. N: Anterior end of *Willinema indicum* Baqri and Jairajpuri, 1967.

FAMILY THORNENEMATIDAE SIDDIQI, 1969

Siddiqi (1969) established the family Thornenematidae for the following genera characterized by having a circular oral opening and pharynx; polycytous intestine; paired ovaries, occasionally single; male with large dorylaimoid spicules, lateral guiding pieces, and non-contiguous ventromedian supplements; tail in both sexes elongate filiform, when dissimilar, the male tail short, usually rounded: *Thornenema* Andrássy, 1959 (type genus); *Mesodorylaimus* Andrássy, 1959; *Drepanodorylaimus* Jairajpuri, 1966; *Prodorylaimus* Andrássy, 1959; *Afrodorylaimus* Andrássy, 1964; and *Lenonchium* Siddiqi, 1965. Andrássy (1969) realized the heterogeneous nature of the family Thornenematidae and removed all the genera from it except *Thornenema*. According to Andrássy, the family Thornenematidae is characterized by having tails of the sexes dissimilar; mono-opisthodelphic female reproductive system; sclerotized lip region; and males rare. We support the removal of other genera by Andrássy (l.c.) from Thornenematidae.

Ferris (1971), while revising the classification of the Dorylaimida did not recognize the family Thornenematidae and transferred all the genera, including *Thornenema*, assigned by Siddiqi, to the subfamily Dorylaiminae de Man, 1876. Probably she was unaware of Andrássy's (1969) publication. We agree with Ferris that on the basis of only a few species the establishment of families should not be recognized because it obscures the relationship, but we disagree with her about the placement of *Thornenema* under Dorylaiminae or even Dorylaimidae because it is unique among all the genera of this group in having the following combination of characters: sclerotized and amalgamated lip region, basal expanded part of oesophagus less than half of the total oesophageal length, S_2N and S_2O located far from base of oesophagus (S_2O about 90% from anterior end), and pre-equatorial vulva.

Baqri & Jairajpuri (1967), while reviewing the genus *Thornenema*, studied a paratype female of *Thornenema parvum* (Williams, 1959) Williams, 1964 and a population of a closely related new species from India. Their study revealed that *T. parvum*, which was originally described under *Labronema* Thorne, 1939 and the Indian population constitute a distinct group because of the rounded female tail unlike *Thornenema* species. They (l.c.) erected a genus *Willinema* for *T. parvum* and for their species *W. indicum*. Siddiqi (1969) synonymised *Willinema* with *Thorneella* Andrássy, 1960 without giving any reason. Ferris (1971) did not agree with Siddiqi and placed this genus under Dorylaiminae. Zullini (1973), while providing the key to the suborder Dorylaimina, also recognized the genus *Willinema* but placed it near *Eudorylaimus* Andrássy, 1959. Baqri & Jairajpuri (1967) had already mentioned that *W. parvum* and their new species *W. indicum* are almost similar to *Thornenema* except for the tail shape. In our work also a dorsoventrally mounted paratype female of *W. indicum* (Fig. 7, N) was examined and it was again confirmed that the genus *Willinema* shares

all the characters of *Thornenema* except the rounded tail. Hence it would be placed near *Thornenema*.

Siddiqi (1971) added a genus *Sicaguttur* to the family Thornenematidae having an amphidelphic reproductive system but sharing all the other characters of *Thornenema*. Ali & Prabha (1974) emended the diagnosis of the genus *Sicaguttur* and proposed a genus *Indodorylaimus* for *Thornenema wickeni* because of their misidentification. They (l.c.) also established a new subfamily Sicagutturinae under Prodorylaimidae for their *Sicaguttur* and *Indodorylaimus* species. According to them the genera *Sicaguttur* and *Indodorylaimus* could not be placed under Thornenematidae because of their similar tails in both sexes which is the characteristic of Prodorylaimidae. The genus *Sicaguttur* has now been confirmed to have dissimilar tails in the sexes like *Thornenema* and *S. sartum* Ali & Prabha to represent a new genus *Mehdinema*. On superficial grounds their arguments of similar or dissimilar tails in the sexes may be convincing to transfer these genera from Thornenematidae but on morphological grounds it is evident that the genera *Thornenema, Sicaguttur, Mehdinema* and *Indodorylaimus* have a common ancestry. In fact the females of *Thornenema* are so similar to *Indodorylaimus* and the females of *Sicaguttur* to *Mehdinema* that it appears difficult to identify the genera from females unless the males are also found. We suggest that these genera should be grouped within the same family.

Recently, Khan (1977) described a new genus *Timminema* with a new species *T. pakistanicum*, based on females, from Lyari river, Karachi, Pakistan. According to Khan (l.c.) this genus comes close to *Thornenema* and *Willinema* in having a sclerotized lip region and other characters, but closer to the latter because of its rounded tail. The genus *Timminema* has been placed under Dorylaimidae and differentiated from *Willinema* mainly in having amphidelphic gonads. Because of the stated resemblance with *Thornenema* and *Willinema, Timminema* should also be transferred from Dorylaimidae. However, the type and only species of *Timminema* is poorly described and illustrated.

With the addition of one more genus *Jairajpuria* in the present study, this group now includes the following genera: *Thornenema, Willinema, Sicaguttur, Indodorylaimus, Timminema, Jairajpuria* and *Mehdinema* which are characterized by having a sclerotized lip region, a basal expanded part of oesophagus less than half of the total oesophageal length, S_2N and S_2O located far from base of oesophagus (S_2O about 90% from anterior end), and pre-equatorial vulva. Hence these genera form their own homogeneous group for which the establishment of the family Thornenematidae is justified.

Our work necessitates amendments in the diagnosis of the family Thornenematidae.

Diagnosis: (emended): Dorylaimoidea. Small to medium sized. Cuticle transversely striated. Lateral, dorsal and ventral body pores may or may not be visible. Lip region with moderately to heavily sclerotized framework; off-set

or continuous with adjoining body; hexagonal in *en face* view; lips bearing the usual number of papillae. Amphids stirrup-shaped, its walls may be sclerotized. Odontostyle cylindrical with wide lumen; aperture about 1/3rd of its own length. Odontophore simple dorylaimid type. Endolids may or may not be present. Basal expanded part of oesophagus less than half of the total oesophageal length; DO and DN located at short distance, S_1N_2 from S_1N_1, S_2N and S_2O located far from base of oesophagus (S_2O about 90% from anterior end). Vulva circular or transverse; pre-equatorial. Female reproductive system mono-opisthodelphic or didelphic. Female tail rounded, elongate conoid to long filiform. Male genital system typical dorylaimid type. Ventromedian supplements non-contiguous. Male tail similar or dissimilar to female, when dissimilar then short bluntly-conoid.

Despite the common characters among the genera listed above there are two distinct groups on the basis of tails in the sexes, i.e., the genera showing more or less sexual dimorphism in tails of the sexes form one group and the genera with similar tails constitute a second group. The first group includes *Thornenema, Sicaguttur* and *Jairajpuria* which are hereby placed under the subfamily Thornenematidae Siddiqi, 1969. The second group includes the following genera having similar tails in both sexes: *Mehdinema, Indodorylaimus, Timminema* and *Willinema*. The last two genera are placed in the second group because we expect that the males of these genera, when recorded, will have rounded tails. Ali & Prabha (1974) have established the subfamily Sicagutturinae to accommodate *Sicaguttur* and *Indodorylaimus* because they found similar tails in the sexes of these genera. Since the type genus of Sicagutturinae, *Sicaguttur*, is placed under Thornenematinae because of dissimilar tails in the sexes, this subfamily ceases to exist and for this new subfamily Mehdinematinae is proposed herewith.

KEY TO GENERA OF THE FAMILY THORNENEMATIDAE

1. Male and female tails similar ... Mehdinematinae 2
   Male and female tails dissimilar ... Thornenematinae 5
2. Tail short, rounded 3
   Tail elongate-conoid or long filiform 4
3. Female reproductive system mono-opisthodelphic ..... *Willinema*
   Female reproductive system amphidelphic ..... *Timminema*
4. Female reproductive system mono-opisthodelphic ..... *Indodorylaimus*
   Female reproductive system amphidelphic ..... *Mehdinema*
5. Female reproductive system amphidelphic ..... *Sicaguttur*
   Female reproductive system mono-opisthodelphic 6
6. Head continuous or slightly narrower than adjoining body, rounded ..... *Thornenema*
   Head well off-set, cap-like ..... *Jairajpuria*

NOTE ADDED IN PROOF

The names *Mehdinema* and Mehdinematinae have to be changed into *Medalinema* and Medalinematinae.

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RÉSUMÉ

Nématodes du Bengale de l'Ouest (Inde)

V. Révision de la famille des Thornenematidae Siddiqi, 1969 (Dorylaimoidea: Nematoda)

La diagnose du genre *Sicaguttur* est amendée par suite du dimorphisme sexuel concernant la queue chez *S. sartum*, dont le mâle est observé pour la première fois; *S. longicaudatum* n.sp., récolté à Azamgarh (Inde), est décrit. *Jairajpuria* n. gen. ayant *J. shamimi* n. sp. pour type et unique espèce, diffère de *Thornenema* par sa région labiale en forme de capuchon et séparée du reste du corps, un sac utérin plus long et la position des noyaux du bulbe oesophagien (S_2N antérieur à S_2O). *Mehdinema prabhae* n. gen., n. sp. est proposé pour *Sicaguttur sartum apud* Ali & Prabha, 1974; *Mehdinema* n. gen. diffère de *Sicaguttur* principalement par la queue de forme identique chez les deux sexes; *M. indicum* (Ali & Prabha, 1974) nov. comb. est proposé pour *Sicaguttur indicum*. *Mehdinema coomansi* n. sp. a été comparé avec *M. prabhae* et *M. indicum*. La comparaison entre une femelle paratype de *Thornenema wickeni* Yeates, 1970 et les specimens identifiés à cette espèce par Ali et Prabha (1974), et pour laquelle ces auteurs avaient proposé le nouveau genre *Indodorylaimus*, a montré que cette identification était erronée; de ce fait *T. wickeni* Yeates demeure dans le genre *Thornenema*. La diagnose de la famille de Thornenematidae est amendée. Les genres *Thornenema*, *Sicaguttur* et *Jairajpuria* n. gen. sont placés dans la sous-famille des Thornenematinae Jairajpuri, 1969. La sous-famille des Sicagutturinae Ali & Prabha, 1974 n'est pas considérée comme valide. Mehdinematinae[1]) subf. nov. (Thornenematidae) est proposé pour regrouper *Mehdinema*[1]) n. gen., *Willinema* Baqri & Jairaipuri, 1967 et *Indodorylaimus*. Une clé des genres appartenant aux Thornenematidae est établie.

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ON THE SPECIES OF *APORCELAIMELLUS* HEYNS, 1965 FROM WEST BENGAL (APORCELAIMIDAE : NEMATODA)

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ABSTRACT

A new species of the genus *Aporcelaimellus* Heyns, 1965, *A. tropicus*, is described from Burdwan district, West Bengal (India) and the male of *Aporcelaimellus chauhani* Baqri & Khera, 1975 is reported for the first time.

INTRODUCTION

The species of the genus *Aporcelaimellus* Heyns, 1965 are widely distributed in West Bengal. During the present course of investigations, the following species have been recorded : *Aporcelaimellus adoxus* Tjepkema *et al.*, 1975 ; *A. chauhani* Baqri & Khera, 1975 ; *A. coomansi* Baqri & Khera, 1975 and *A. heynsi* Baqri & Jairajpuri, 1968. Three populations collected from soil around roots of paddy at Burdwan district in West Bengal represent a new species of *Aporcelaimellus* which is described hereunder as *A. tropicus*. Besides, the male of *A. chauhani* is also reported for the first time.

MATERIAL

The type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta. *A. tropicus* : Holotype female alongwith 3 paratype females and 2 paratype males on slide No. WN-385. Specimens of Kantapur and Maghlampur populations on slide No. WN-386 and WN-387 respectively.

Aporcelaimellus tropicus n. sp.

(Fig. 1, A—H)

Measurements :

Saldah Population (Type)

Holotype female ; L=1.51 mm ; a=46 ; b=4.1 ; c=76 ; V= $\overset{14}{}$ $\overset{12}{57}$

Paratype females (3) ; L=1.55–1.76 mm ; a=43–50 ; b=4.1–4.9 ; c=74–82 ; V= $\overset{7\text{-}14}{55\text{-}57}$ $\overset{12\text{-}16}{}$

Paratype males (2) ; L=1.60–1.63 mm ; a=47–49 ; b=4.8 ; c=64–71 ; T=54–56 ;

Kantapur population ;

Females (3) L=1.44–1.66 mm ; a=39–45 ; b=3.8–4.9 ; c=63–72 ; V= $\overset{11\text{-}13}{56\text{-}62}$ $\overset{11\text{-}15}{}$

Males (5) ; L=1.67–1.80 ; a=44.0–53.6 ; b=4.7–4.9 ; c=64–77 ; T=51–59 ;

Maghlampur populations ;

Females (2) ; L=1.68–1.70 mm ; a=48–50 ; b=4.5 ; c=67–78 ; V= $\overset{13\text{-}14}{56\text{-}57}$ $\overset{11\text{-}12}{}$

Males (2) ; L=1.61-1.64 ; a=49-51 ; b=4.2-4.6 ; c=60–75 ; T=54.

Description :

Female : Body ventrally curved in the posterior half of its length, tapering gradually anterior to slender part of oesophagus. Cuticle distinctly striated transversely ; its thickness 2-5 μm (thickest on tail). Lateral chords 1/5th to 1/4th of the body-width near middle. Lateral body pores irregularly arranged along both sides of lateral chords, 32-38 in number of which 6 to 8 in oesophageal region, 20 to 24

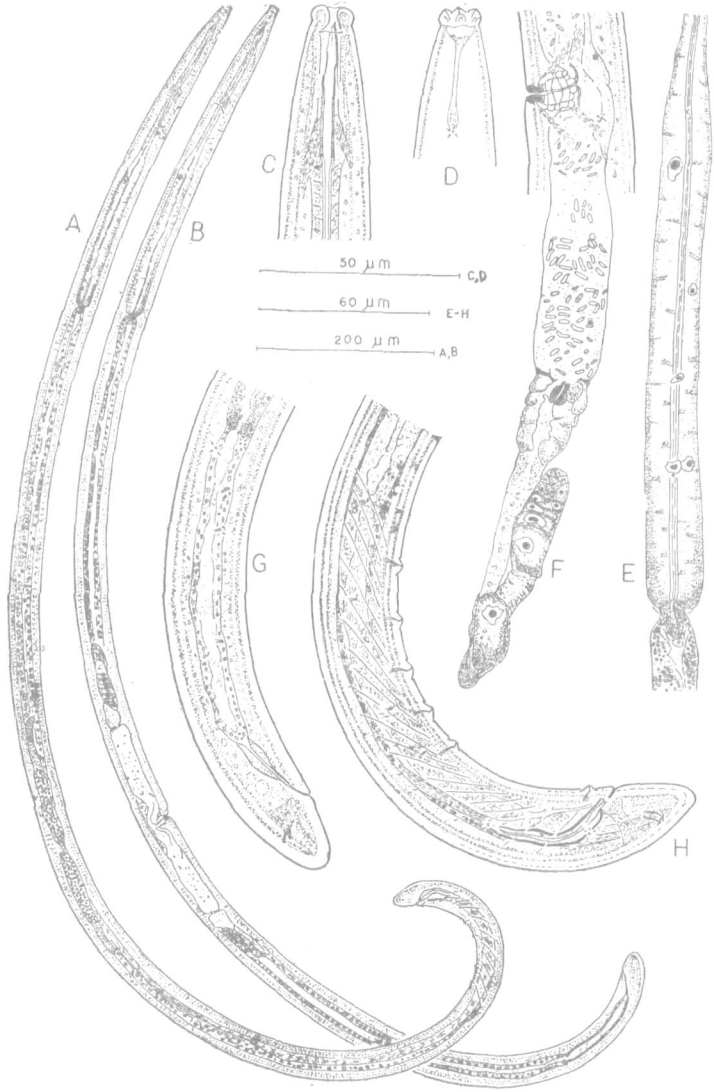

Fig. 1. (A-H) *Aporcelaimellus tropicus* n. sp. A : Entire male ; B : Entire female ; C : Anterior end of female ; D : Surface view of female showing Amphid ; E : Basal expanded portion of oesophagus ; F : Posterior female reproductive system ; G : Female tail ; H : Male tail.

in the intestine region, 4 to 5 in prerectum and rectum and 2 in caudal region.

Lip region off-set, wider than adjoining body, its width about 1/3rd of body-width at base of oesophagus. Amphid 6-8 μm wide, stirrupshaped and apparently divided by a thin partition wall ; apertures occupying 60-70% of the corresponding body-width. Sensillar pouches 21-23 μm from amphidial aperture.

Odontostyle 12-14 μm or 1.0-1.4 lip-region-width long ; apertures 7-8 μm or 58-62% of odontostyle length. Guiding ring 6-7 μm or 0.5-0.6 lip region-width from anterior end. Odontophore 20-22 μm or 1.4-1.8 times the odontostyle length. Nerve ring 106-118 μm or 30-34% of neck region from anterior extremity. Basal expanded part of oesophagus 46-54% of the total oesophageal length. Locations of oesophageal gland nuclei and their orifices as follows :

DO—53.8-57.3	S_1 N_1—69.7-72.7	S_2 N—86.9-87.3
DN—59.3-62.4	S_1 N_2—78.7-80.0	S_2 O—88.0-88.7
DO-DN—5.1—5.6	K—48-58	K′—60—68.

Cardia tongue-shaped enveloped by intestinal tissue. Oesophago-intestinal disc absent. Prerectum 83-113 μm or 4-5 times the anal body-width, in one paratype female 171 μm or 7 times the anal body-width. Rectum 25-33 μm long or 1.0-1.3 times the anal body-width.

Vulva a transverse slit. Vagina 17-23 μm, about half of the corresponding body-width ; surrounded by sphincter muscles ; moderately selerotized at vulva-vagina junction. Female reproductive system amphidelphic, typical. Uterus and oviduct separated by sphincter muscles. Uteri filled with sperms.

Tail bluntly conoid, 22-24 μm or 0.8-1.0 anal body-width long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology. Male genital system typical, dorylaimid. Spicules 42-47 μm or 1.6-2.0 anal body-width long when measured along the median line. Lateral guiding pieces well developed, 9-12 μm long. In addition to adanal pair, 3-5 regularly spaced ventro-median supplements. Copulatory muscles 19-23 and reaching up to the last supplement. Prerectum 98-167 μm or 4.8 to 5.2 anal body-widths long. Tail similar to female in shape, 22-27 μm or about one anal body-width long.

Type locality and habitat : From soil around roots of paddy, *Oryza sativa* L., at Saldah, Block Memari, District Burdwan, West Bengal, collected by Dr. Q. H. Baqri & party during December, 1977.

Kantapur and Maghlampur populations were collected from soil around roots of paddy at Kantapur and Maghlampur respectively, Block Memari, District Burdwan, West Bengal.

Differential diagnosis : *Aporcelaimellus tropicus* n. sp. comes close to *A. heynsi* Baqri & Jairajpuri 1968 and *A. paraconicaudatus* (Mey[1], 1956) Heyns, 1965. From the former it differs in having longer body (L=0.98-1.22 mm in *A. heynsi*), larger odontophore (Odontophore 17-19 μm in *A. heynsi*), differently shaped amphids and vagina, no oesophago-intestinal disc, shorter and bluntly conoid tail (tail 29-41 μm long and conoid in *A. heynsi*). From *A. paraconicaudatus* the present new species differs in shorter odontostyle (odontostyle 16 μm in *A. paraconicaudatus*), longer and differently shaped tail (c=25, and conoid tail in *A. paraconicaudatus*) ; shorter spicules and 3 to 5 ventromedian supplements in males (spicules more than 50 μm and 14 to 16 ventromedian supplements in *A. paraconicaudatus*).

Aporcelaimellus chauhani Baqri & Khera, 1975
(Fig. 2. A, B)

Measurement :

Females (3) ; L=1.51–1.90 mm ; a=26-34 ; b=3.9 8-11 8-12. –4.3 ; c=31–38 V= 50-54

Male : (1) ; L=1.88 mm ; a=34 ; b=4.01 ; c=38, T=57.

Baqri and Khera (1975) described *A. chauhani* on the basis of females. The present

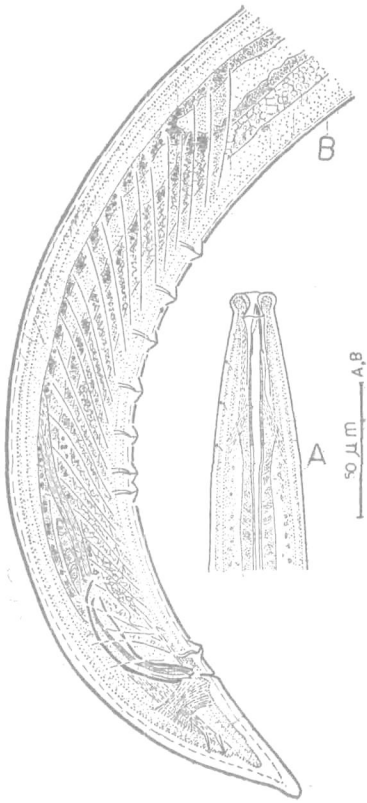

Fig. 2. A & B. *Aporcelaimellus chauhani* Baqri and Khera, 1975.
A : Anterior end of male ; B : Posterior region of male tail.

population which included a single male resembles in every respect with the type specimens of *A. chauhani* except in having longer body. (L=0.96-1.42 mm).

Male : Similar to female in general shape and morphology except the male genital system. Spicules 55 µm or near about 1.6 anal body-width long when measured along the curved median line. Lateral guiding pieces 14 µm long, In addition to an adanal pair, seven regularly well-spaced ventromedian supplements present. Copulatory muscles 24, reaching up to the last supplement. Prerectum 179 µm or about 5 anal body-widths long.

Tail dorsally convex-conoid with subacute terminus, 56 µm or 1.6 anal body-widths long.

Habitat and locality : From soil around roots of Ladies finger, *Hibiscus esculentus* L. at Beledanga, District Hooghly, collected by A. Jana in March, 1977.

Aporcelaimellus adoxus Tjepkema, Ferris, and Ferris, 1971

Two females from soil around roots of unidentified grass at Memari, District Burdwan.

Aporcelaimellus heynsi Baqri & Jairajpuri, 1968

Autpara population : Five females from soil around roots of paddy, *Oryza sativa* L., at Autpara, Block Jamalpur District Burdwan.

Masaq am population : Thirteen females from soil around roots of paddy, *Oryza sativa* L., at Masagram, Block Jamalpur, District Burdwan.

Aporcelaimellus coomansi Baqri & Khera, 1975

Four females from soil around roots of banana, *Musa* sp., at Reang, District Darjeeling.

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Bull. zool. Surv. India, 3 (3) : 239-247, 1981

NEMATODES FROM WEST BENGAL (INDIA) VII. MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN *TYLENCHORHYNCHUS NUDUS* ALLEN, 1955 (TYLENCHORHYNCHIDAE : TYLENCHIDA)

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ABSTRACT

The study of a single population of *Tylenchorhynchus nudus* Allen, 1955 from West Bengal (India) reveals that the length of stylet, the position of dorsal oesophageal gland orifice and the median oesophageal bulb, value of 'V', and lip height and width are less variable characters. The length of sexual branches, tail annules and the position of phasmids are highly variable characters.

MATERIAL

The nematodes were fixed in hot 4% formalin, dehydrated slowly in desiccator and mounted in anhydrous glycerine. The specimens have been registered and deposited with the National Zoological collection, Zoological Survey of India, Calcutta.

INTRODUCTION

Intraspecific variations occur frequently in nature within the same or different populations of a species. Several workers have studied the qualitative and quantitative variations in different species of nematodes (Goodey, 1952 ; Rhode & Jenkins, 1957 ; Triantaphyllou & Sasser, 1960 ; Bird & Mai, 1967 ; Baqri & Jairajpuri, 1970 ; and Roman & Hirschmann, (1969). Loof & Maas (1972), while studying the intraspecific variations among the different populations of *Xiphinema* species, observed that the qualitative characters are also important in distinguishing nematode species. Recently from India, the morphometric and allometric studies have been made by Azmi & Jairajpuri (1976) in *Helicotylenchus indicus* Siddiqi, 1963 ; Rashid & Khan (1976) in *Pratylenchus coffeae* (Zimmermann, 1898) Filipjev & Stekhoven, 1941 ; and Bajaj & Jairajpuri (1977) in *Xiphinema basiri* Siddiqi, 1959.

The present paper deals with the morphometric and allometric variations observed in *Tylenchorhynchus nudus* Allen, 1955 from Shaktigarh, district Jalpaiguri, West Bengal.

Tylenchorhynchus nudus Allen, 1955

(Figs. 1-5)

Dimensions : Table I.

Description : *Female* : Body curved in posterior half of its length upon fixation and tapering slightly towards both extremities. Cuticle marked with distinct transverse striae, 1-2 μm apart. Longitudinal striations absent. Lateral fields originate with two incisures below the base of stylet, become three near

TABLE—I

Morphometric and Allometric Variations in Adults of *Tylencorhynchus nudus*

	Female				Male			
Character	Range	Mean ± S. D.	S. E.	C. V. (%)	Range	Mean ± S. D.	S. E.	C. V. (%)
Length (μ)	602-863	688±45.0	4.96	6.5	516-726	645±46.0	7.10	7.0
a	26-35	29 ±2.1	0.24	7.4	25-35	30 ±2.6	0.41	8.7
b	5.1-6.4	5.6 ±0.3	0.04	6.0	4.3-6.0	5.3±0.4	0.06	8.0
c	12.5-16.4	12.9±1.3	0.15	10.5	11-17	14.6±1.4	0.23	10.0
V/T	53-57	55 ±1.2	0.13	2.0	43-59	51 ±5.5	0.88	10.9
G_1	13-28	22 ±3.2	0.37	15.0	—	—	—	—
G_2	16-26	22 ±2.3	0.26	11.0	—	—	—	—
Cuticle at mid body (μ)	1-2	1.8 ±0.3	0.04	19.0	1-2	1.8±0.2	0.04	15.0
Annules (μ)	2-2.5	2.0 ±0.08	0.01	4.4	1.8-2	1.99±0.03	0.0	1.5
Lateral fields (μ)	4-7	5.4 ±0.5	0.06	9.0	4.3-6.0	5.1±0.5	0.08	9.8
Incisures	4	4 ±0	0.0	0.0	4	4 ±0	0.0	0.0
Labial annules	0-2	—	—	—	0-2	—	—	—
Head height (μ)	3.5-4-0	3.41±0.09	0.09	2.8	3.4-4.0	3.41±0.09	0.01	2.7
Head width (μ)	6-8	7 ±0.3	0.08	4.5	6-7	6.8 ±0.3	0.06	5.3
Stylet (μ)	18-21	19 ±0.6	0.07	3.4	18-20	19 ±0.4	0.07	2.0
Stylet knobs (μ)	3.5-4.0	3.41±0.1	0.01	2.0	3.4-3.5	3.4 ±0.09	0.01	2.7
Metenchium (μ)	8.5-10.5	9.5 ±0.4	0.05	4.6	8.6-10	9.2±0.2	0.04	3.0
Dorsal oesophageal gland opening (μ)	2-3	2.4 ±0.1	0.01	4.0	2.0-2.5	2.4±0.1	0.04	5.0
oesophagus* (μ)	103-144	123±8.1	0.37	6.5	111-142	124±8.0	1.23	6.4
Median bulb* (μ)	54-75	64±4.5	0.05	7.0	56-71	64±4.2	0.68	6.7
Median oesophageal bulb length (μ)	13-15	14 ±0.7	0.08	5.3	12-14	13±0.5	0.08	4.0
Median oesophageal bulb width (μ)	9-12	9.7 ±0.6	0.07	7.0	9-10	9.2±0.4	0.04	4.3
Nerve ring* (μ)	69-94	81 ±4.9	0.54	6.0	73-91	83 ±5.3	0.18	6.4
Excretory pore* (μ)	87-124	101±7.0	0.77	7.0	85-115	102±6.6	1.02	6.4
Hemizonid	0-2 anules from excretory pore					0-2 annules from excretory pore		
Hemizonid width	1-2 annules					1-2 annules		
Vulva*	319-475	376±25.0	0.73	6.6	—	—	—	—
Anterior gonad (μ)	99-211	148±24.0	2.68	16.0	—	—	—	—
Posterior gonad (μ)	112-189	147±17.0	1.89	11.5	—	—	—	—
Vagina (μ)	8-11	9±0.6	0.07	6.7	—	—	—	—
Vulva body-width (μ)	20-26	23 ±1.6	0.19	7.0	17-23	22±1.6	0.26	7.7
Anal body diameter (μ)	10-15	14 ±0.9	0.11	7.0	14-18	16±1.0	0.16	7.7
Rectum (μ)	9-14	10 ±1.3	0.16	13.0	—	—	—	—
Tail (μ)	40-59	47 ±3.7	0.40	8.0	36-51	44±4.1	0.66	9.5
Tail annules	13-23	18 ±2.5	0.29	14.5	—	—	—	—
Phasmids (from terminus) (μ)	34-48	37 ±4.2	0.46	11.0	26-39	30±3.1	0.50	10.6
Spicules (μ)	—	—	—	—	22-27	25±1.4	0.24	6·0
Gubernaculum (μ)	—	—	—	—	11-14	12.8±0.99	0.16	7.7

*Distances from anterior end (μ)

S. D. = Standard deviation

S. E. = Standard error

C. V. = Coefficient of variability

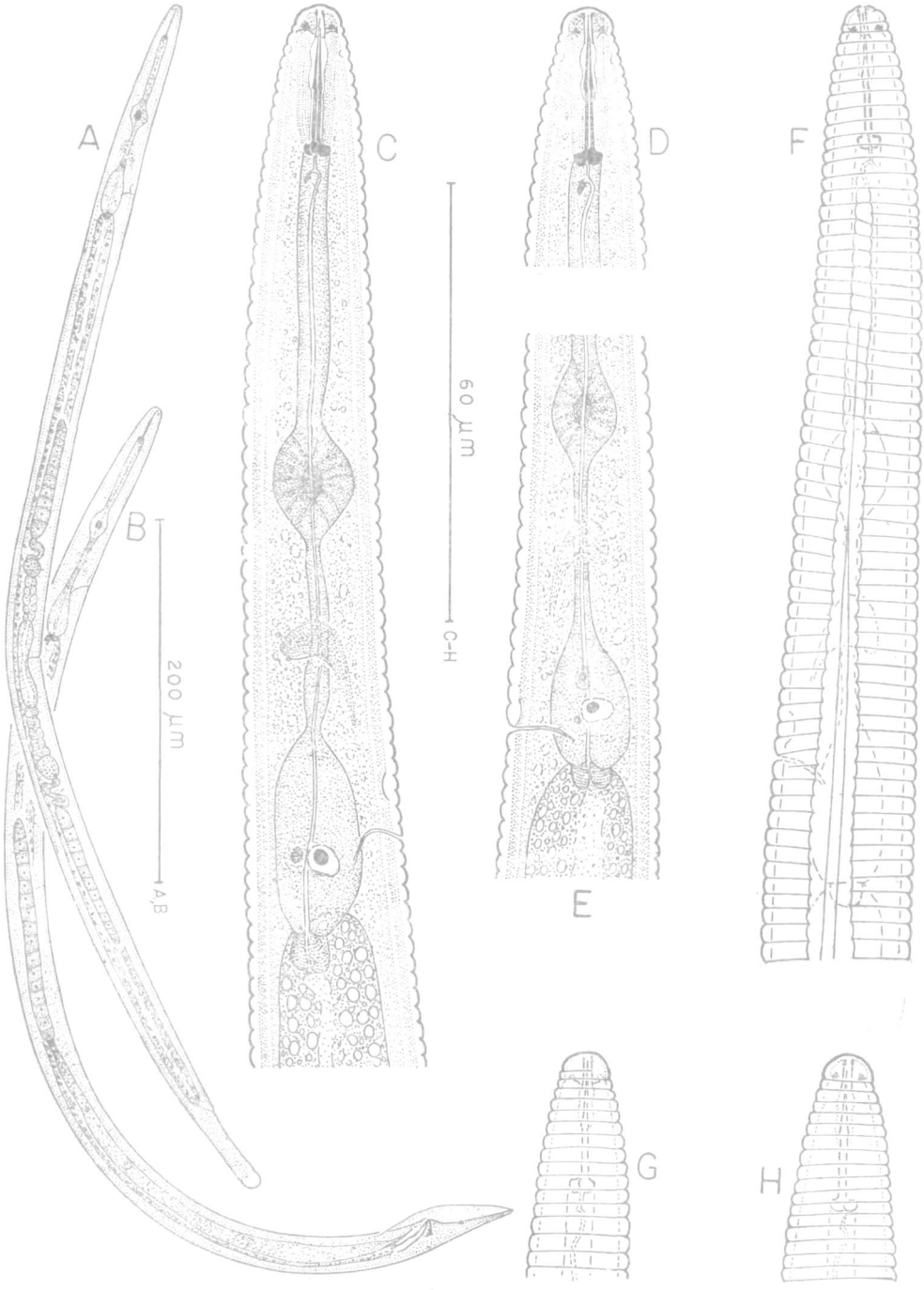

Fig. 1. *Tylenchorhynchus nudus* Allen, 1955 : A. Entire female ; B. Entire male ; C. Oesophageal region ; D. Anterior end ; E. Oesophageal region showing variation in position of hemizonid and excretory pore ; F. Anterior region, surface view ; G. Anterior end, lip region with incomplete stria ; H. Anterior end, lip region without stria.

middle of procorpus and four between median bulb and nerve ring (Fig. 1, F). The outer incisures are crenate. The four incisures extend up to the terminus (Fig. 2, D) but sometimes the inner two unite just below the phasmids (Fig. 2, F). Aerolations absent. Lateral fields 1/5th-1/4th of body-width near middle.

Lip region continuous with body, 6-8 μm wide and 3-4 μm high, generally bearing two annules (Fig. 1, F). Smooth lip region has also been noted in some specimens (Fig. 1, H). Sometimes the stria is incomplete and it appears from one side as if the lip region is smooth (Fig. 1, G). Head framework slightly sclerotized. Stylet 18-21 μm long, about 2.4-3.0 times the head-width ; its anterior part (metenchium) 9-11 μm long or 47-52% of the stylet length. The basal knobs rounded, 3-4 μm wide. Oesophagus typical to genus. Median oesophageal bulb at 45-57% of the oesophageal length from anterior end, 12-15× 9-12 μm. Orifice of the dorsal oesophageal gland 2-3 μm from stylet base. Nerve ring 69-94 μm or 58-71% of the oesophageal length from anterior end. Excretory pore 85-124 μm or 65-94% of the oesophageal length from anterior extremity, position varies from anterior end to posterior end of oesophageal terminal bulb (Fig. 1, B & E). Hemizonid 1-2 annules long, situated 0-2 annules above the excretory pore (Fig. 1, C & E).

Vulva a transverse slit. Vagina 1/3rd—1/2 of corresponding body-width. Reproductive system amphidelphic, out streched. Each sexual branch consists of an ovary, oviduct, spermatheca and uterus. Spermatheca ovate or spherical and mostly filled with sperms. Oocytes arranged in a single row (Fig. 2, A & B), in one specimen in double rows with reflexed anterior part of ovary (Fig. 2, C). Tail cylindrical, ending in a clavate terminus, marked with 13-23 striae ventrally and 2.5-4.0 anal body-widths long. In one specimen, some apperent abnormal markings were noticed at the tail terminus (Fig. 2, E). Rectum 9-14 μm or about half to one anal body-width long. Phasmids 33-48 μm or 72-93% of the tail length from tail terminus. Generally both the phasmids occur at the same level but in some specimens noticed about one annule apart (Fig. 2, G & E).

Male : Similar to female in general shape and morphology except the reproductive system and tail shape. The two inner incisures of the lateral fields terminate before cloaca, the third one terminates before phasmids and outer most continues up to the tail terminus. Spicules 22-27 μm long medially. Gubernaculum stout, 11-14 μm long, proximal half slightly or distinctly curved with distinct spine-like structure near curvature. Tail with subacute terminus, 2.3-3.4 anal body-widths long, enveloped by bursa. Phasmids 26-39 μm or 58-83% of tail length from tail terminus.

Discussion

Table No. I, shows all the measurements and statistical calculations. The occurence of the lip region bearing two annules has been calculated in 77% specimens while for the smooth lip region or with incomplete stria in 23% specimens. The absence of stria or incomplete stria in the lip region have been observed for the first time in this species. The frequency of specimens having 18 μm long stylet has been noted in only 3%, maximum being 19 μm in 71%, with 20 μm in 21% and 21 μm in 5% (Fig. 3).

Among all the morphometric characters, the length of stylet and its metenchium, head width, head height, and position of dorsal oesophageal gland opening and median oesophageal bulb are found to be less variable

Fig. 2. *Tylenchorhynchus nudus* Allen, 1955 : A. Female reproductive system showing spermatheca filled with sperms; B. Female reproductive system showing spermatheca without sperms ; C. Female anterior reproductive system with reflexed ovary and double rows of oocytes ; D-E. Female tails ; H-J. Male tails.

characters (C. V.=2–5%). Hence these characters can be used safely in the identification of this species. The highly variable characters are the length of sexual branches from 6–10%, are the lateral fields, length of oesophagus, position of nerve ring and excretory pore, tail length, length of vagina, and length of spicules and gubernaculum.

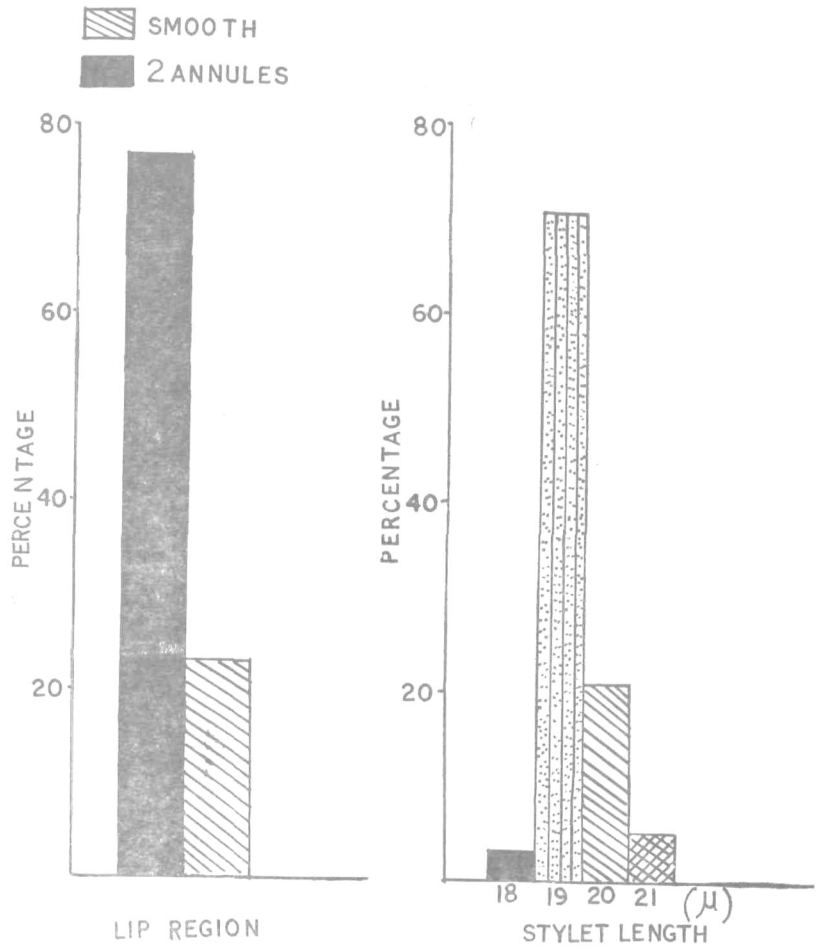

Fig. 3. Histograms showing the percentage of specimens having lip region with or without annules, and different stylet lengths.

(C. V.=11–16%), rectum (C. V.=13%), the number of tail annules (C. V=15%) and the position of phasmids from tail terminus (C. V.=11%). The characters which showed a moderate degree of variations, C. V. ranging

As far as allometric characters are concerned, it has been observed that position of vulva is positively correlated with the body length, while the length of tail and female sexual branches has been found negatively

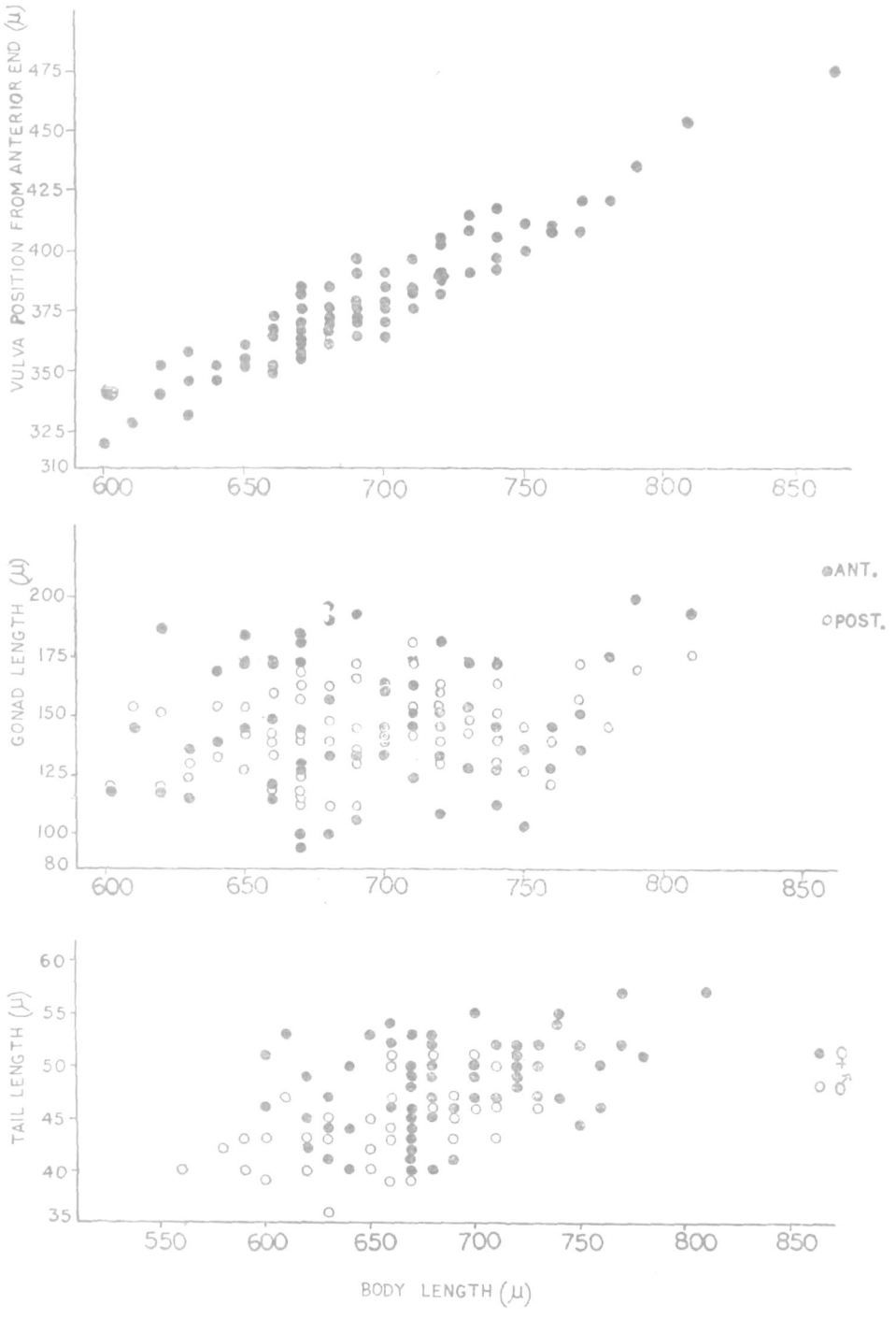

Fig. 4. Relation of body length with tail length, gonad length and vulva position.

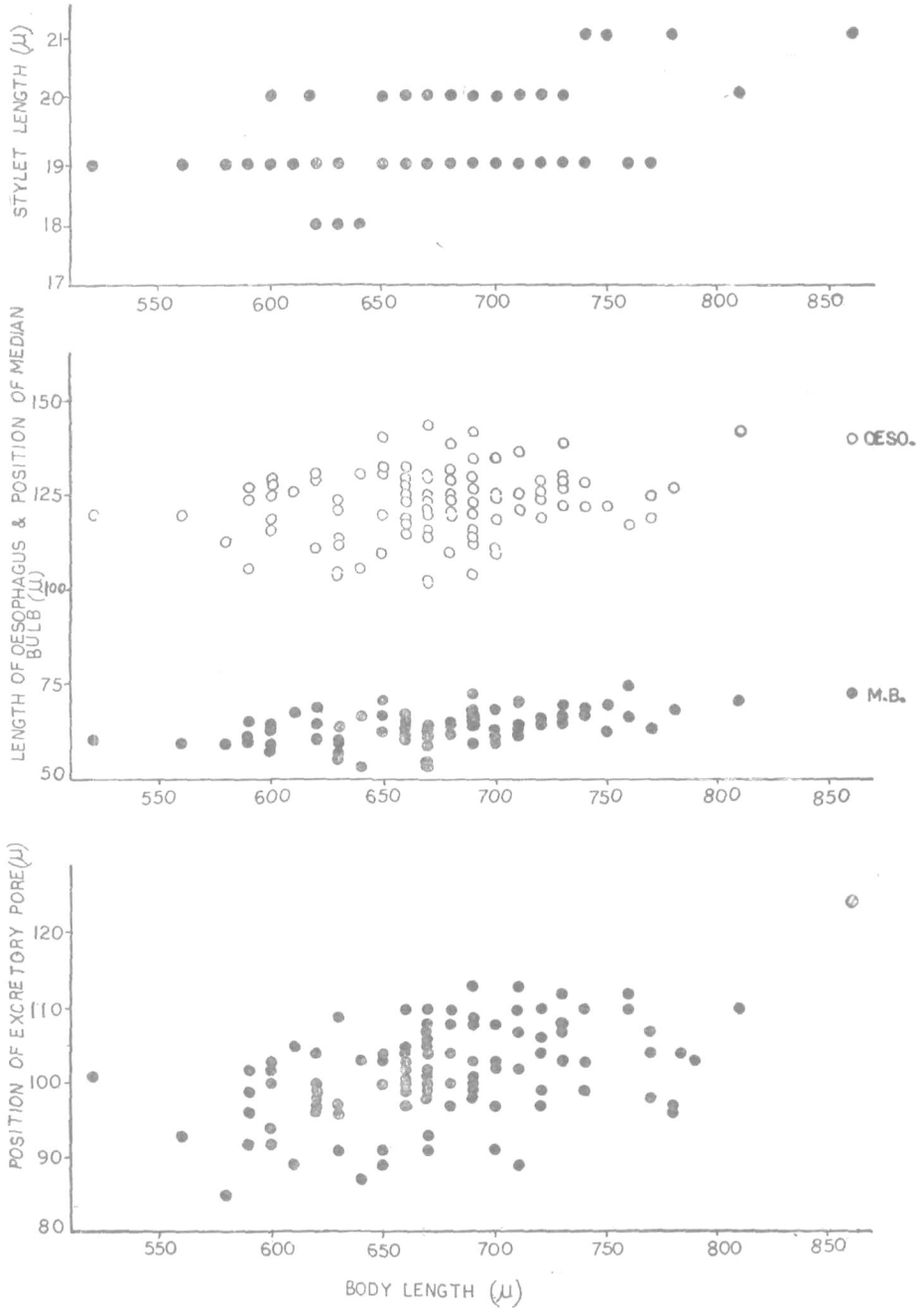

Fig. 5. Relation of body length with position of excretory pore, length of oesophagus and position of median oesophageal bulb, and stylet length.

correlated to the body length (Fig. 4). Among all the allometric characters, the value of 'V' is the least variable character (C. V. = 2%) while the G_1 and G_2 exhibit maximum variations (C. V. = 15% and 11% respectively). These results agree fully with the findings of Bird & Mai (1967) in *Trichodorus christei* Allen, 1957 = syn. of *Paratrichodorus minor* (Colbran, 1956) and partly with Mujib & Jairajpuri (1976) in *Helicotylenchus indicus* Siddiqi, 1963. The length of stylet and oesophagus, the position of median oesophageal bulb and excretory pore were also found independent of body length (Fig. 5), and thus can be used to differentiate this species from closely related species. These observations are also in accordance with Mujib & Jairajpuri (1976) and many others (Wu, 1960 ; Sturhan, 1963 ; Tarjan, 1969 ; and Bajaj & Jairajpuri, 1977).

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Bull. zool. Surv. India, 4(1) : 37—39, 1981

A NEW SPECIES OF THE GENUS *PARALONGIDORUS* (LONGIDORIDAE : NEMATODA)

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ABSTRACT

A new species of the genus *Paralongidorus*, *P. distinctus*, belonging to the family Longidoridae (Nematoda) is being described from Rohtang Pase, district Kulu, Himachal Pradesh. *Paralongidorus distinctus* n. sp. is characterized by having 7.35 mm long body, odontostyle 161 µm, odontophore 86 µm, guiding ring 45 µm from anterior end and tail less than one anal body-width long.

INTRODUCTION

The present paper reports a new species of plant parasitic nematode, *Paralongidorus distinctus* n. sp. collected from Rohtang Pass, Kulu, Himachal Pradesh, India. The type locality is situated at an altitude of 14,000 ft. and remains under snow during the major part of the year.

MATERIAL AND METHODS

Collected by the second author in October, 1970 ; fixed in hot 4% formalin and mounted on slide H. A. 5/*Paralongidorus distinctus*/1, juveniles on slides H. A. 5/*Paralongidorus distinctus*/2-3 ; deposited with the Museum of Department of Zoology, Aligarh Muslim University, Aligarh (U. P.).

Paralongidorus distinctus n. sp.

Measurements :

Female (*Holotype*) : L=7.35 mm ; a=86 ; b=11.6 ; c=223 ; $V=^{10\cdot7}\,48^{9\cdot6}$.

Juveniles (3) : L=1.71—3.33 mm ; a=49—72 ; b=5.1—7.0 ; c=43—77 ; odontostyle=82—111 µm ; odontophore=40—66 µm ; guiding ring from anterior end=24—34 µm.

Description : Body ventrally curved in posterior two-thirds of its length, tapering slightly towards extremities. Cuticle smooth except at tail end where it is marked with fine transverse striations. The thickness of the cuticle varies from 4-10 µm on different partl of body (6 µm at head end and 10 µm on tai

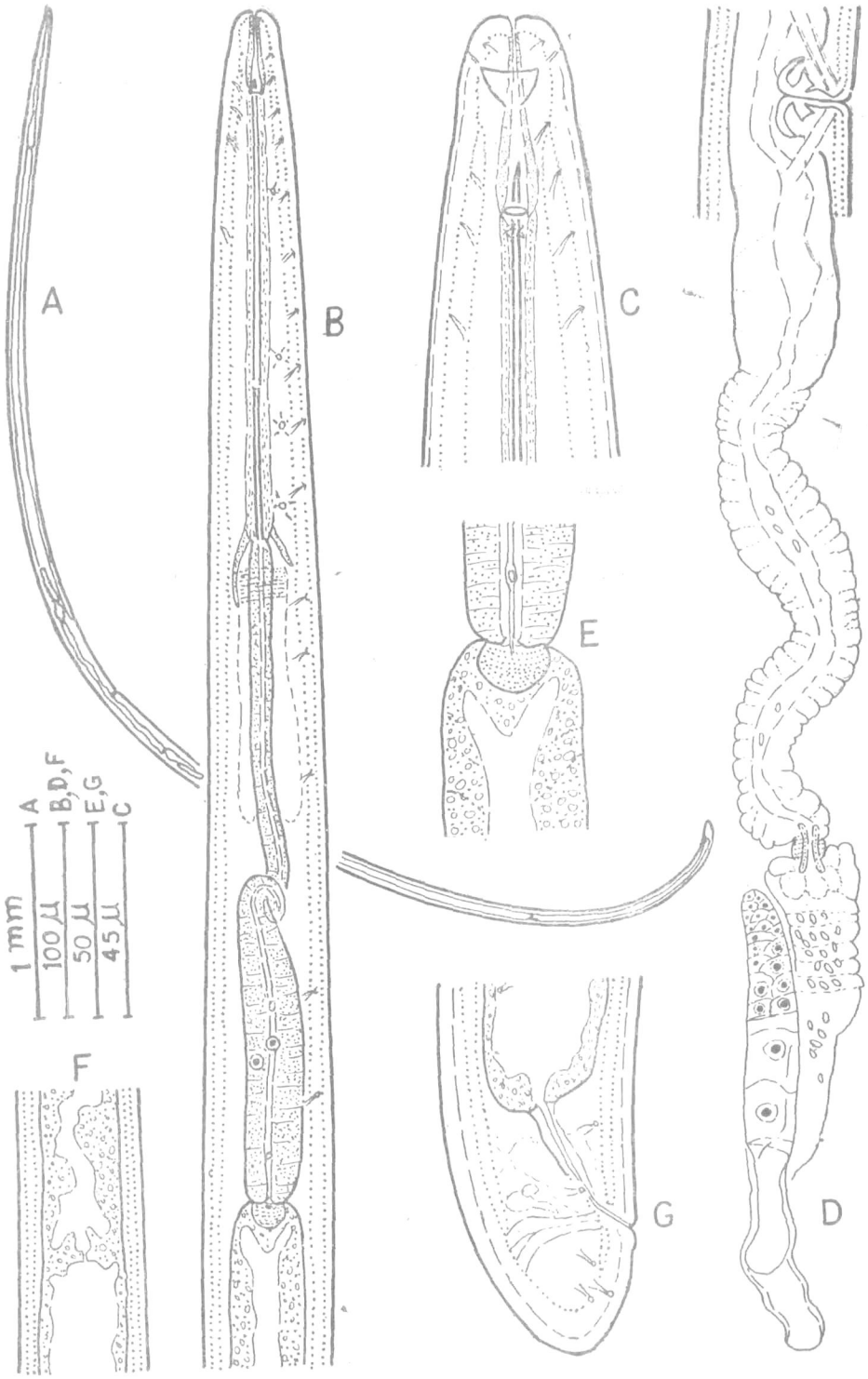

Fig. 1. *Paralongidorus distinctus* n. sp. A=Female entire, B=Oesophageal region, C=Head end, D=Posterior gound, E=Cardia region, F=Intestine prerectum junction, G=Tail.

tip). Lateral chords about $\frac{1}{4}$th of body-width near middle. Lateral body pores inconspicuous except at anterior and posterior ends. Dorsal body pores 4, situated in the odontostyle region ; ventral body pores 15 restricted to oesophageal region.

Lip region continuous with body, subtruncate. A slight depression is present at level of base of amphidial pouch. Amphids stirrup-shaped with slit-like apertures, 12 µm from anterior end and occupy about half of corresponding body-width. Sensillar pouches not seen. Odontostyle 161 µm or 6.5 lip region-widths long. Guiding ring 45 µm or 1.8 lip region-widths from anterior end of body. Odontophore 86 µm or slightly more than half of odontostyle length.

Basal expanded portion of oesophagus about 25% of oesophageal region. The oesophageal gland nuclei and their orifices are situated as below :

$DO = 74.9 \quad S_1N_1 = 86{\cdot}6 \quad S_2O = 96$

$DN = 75.7 \quad S_1N_2 = 89.7$

$DO - DN = 0.8$

Nerve ring surrounds the anterior slender part of aesophagus at 302 µm or 47% of oesophageal region from anterior end of body. Cardia semi-conoid, enveloped by intestinal tissue. Prerectum 1.11 mm long or about 25 times the anal body-widths.

Vulva transverse. Vagina 42 µm or about half the corresponding body-width. Gonads amphidelphic. Uterus and oviduct separated by a well developed sphincter. Ovary reflexed ; oocytes arranged first in a single row, then in double row and at the tip in multiple rows. Sperms present in oviduct.

Tail obtusely rounded, 33 µm or about 0.7 anal body-width long with 3 caudal pores on each side.

Male : Not found.

Habitat : Soil around the grasses (unidentified) from Rohtang Pass, district Kulu, H. P.

Differential diagnosis : Paralongidorus distinctus n. sp., comes close to *Paralongidorus strelitzae* (Heyns, 1966) Aboul-Eid, 1970 but differs in having longer odontostyle (odontostyle 117-131 µm in *P. strelitzae*), anteriorly situated guiding ring (55-65 µm from anterior end in *P. strelitzae*), longer prerectum (three times the corresponding body-width in *P. strelitzae*), inconspicuous lateral body pores, and shorter and differently shaped tail (c = 148-161 in *P. strelitzae*).

ACKNOWLEDGEMENT

The authors are thankful to the Director of Zoological Survey of India, Calcutta, and Prof. S. Mashhood Alam, Head of the Zoology Department, Aligarh Muslim University, Aligarh, for providing the research facilities in their respective departments.

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Bull. zool. Surv. India, **4** (2) : 209-211, 1981

NEMATODES FROM WEST BENGAL (INDIA) X. A NEW SPECIES OF *ANATONCHUS* (COBB, 1916) DE-CONINCK, 1939 (ANATONCHIDAE : MONONCHIDA)

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ABSTRACT

Antonchus sukuli n. sp. is being described from around roots of an insectivorous plant, *Drosera burmanni* at Santiniketan, district Birbhum, West Bengal. The new species is characterized by having L=4.38-4.93 mm, buccal cavity 62-73×52-71 μm, distally sclerotized and highly muscular vagina and male with 142-148 μm long spicules.

INTRODUCTION

The present material was sent by Dr. N. C. Sukul, Reader in Zoology Department at Visva Bharati University, West Bengal for identification. These specimens represent a new species of the genus *Anatonchus* (Cobb, 1916) De Coninck, 1939 which is described hereunder as *Anatonchus sukuli*.

This species is named after Dr. N. C. Sukul.

MATERIAL

The type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta. *Anatonchus sukuli* : Holotype female on slide WN 448, paratype males on slide WN 449.

Anatonchus sukuli n. sp.

(Fig. 1)

Measurements :

Holotype Female : L=4.93 mm ; a=47 ; b=5.0 ; c=8 ; V=$^{11}64^{11}$.

Paratypes (2 ♂♂) : L=4.38-4.72 mm ; a=43-46 ; b=5.1-5.2 ; c=12 ; T=39-42.

Description :

Body ventrally curved in the posterior half upon fixation, tapering slightly anterior to base of oesophagus but markedly posteriorly. Cuticle 3-4 μm thick at mid-body, finely striated. Lateral chords about 1/5th-1/4th of corresponding body-width near middle. Lip region slightly wider than adjoining body, 62-73 μm wide and 18-21 μm high.

Amphids funnel-shaped, apertures 8-10 μm wide. Sensillar pouches 17-18 μm from amphidial slits.

Buccal cavity 62-73×52-71 μm; its walls are weakly developed. Three medium sized teeth hinged to anterior wall of buccal cavity

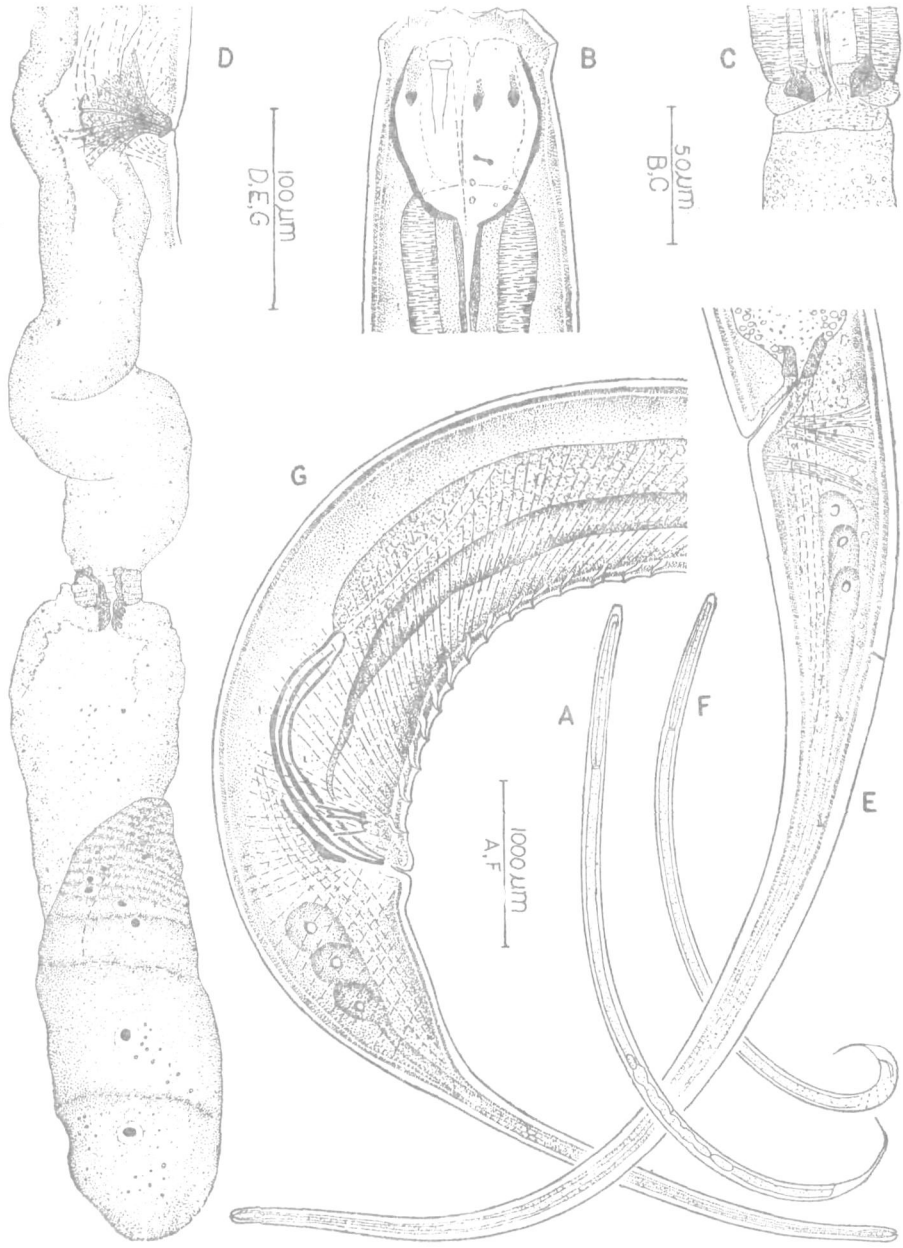

Fig. 1. *Anatonchus sukuli* n. sp. : A—Entire female, B—Head end, C—Oesophago-intestinal junction, D—Female posterior gonad, E—Female tail, F—Entire male, G—Male posterior region.

at 43-50 μm or about 68-71% from base of stoma. Oesophago-intestinal junction tuberculate. Nerve ring 201-225 μm or 23-24% of neck region from anterior end. Rectum 50 μm long.

Female reproductive system amphidelphic. Vulva a transverse slit. Vagina moderately sclerotized distally, extending inwards 41 μm or less than $\frac{1}{3}$rd of corresponding body-width, marked with muscular bands, surrounded by sphincter. Uterus and oviduct are separated by a well developed sphincter which is almost like a flower. Ovaries reflexed ; oocytes arranged in a single row except in growth region. Tail elongate, 590 μm or about 7.5 anal body-widths long. Caudal glands three, leading to a terminal duct.

Male is similar to female in general shape except more curved in posterior third of body. Male reproductive system typical. Spicules 142-148 μm or about 1.6-1.7 anal body-widths long medially. Gubernaculum 45-47 μm and lateral accessory pieces 18-19 μm long. Supplements 14-15, spaced nearly at regular intervals. Copulatory muscles 44-46 in number. Tail similar to female, 360-398 μm or 4.2-4.4 anal body-widths long.

Type habitat and locality : Collected from soil around roots of an insectivorous plant, *Drosera burmanni*, at Santiniketan, district Birbhum, West Bengal (India).

Differential diagnosis : *Anatonchus sukuli* n. sp. comes close to *A. ginglymodontus* Mulvey, 1961 but differs from it in having longer body, differently shaped tail, larger buccal cavity, pre and post-vulval papillae absent, distally sclerotized and highly muscular vagina, and male with longer and differently shaped spicules (L=2.2-2.9 mm; tail gradually tapering, buccal cavity 50-63×40-51 μm, pre and post-vulval papillae present, vagina neither distally sclerotized nor marked with muscular bands, and male with 110 μm long spicules in *A. ginglymodontus*).

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, Calcutta for providing the research facilities and to Dr. N. C. Sukul for allowing us to publish the description of the present new species. We thank Dr. K. C. Jayaramakrishnan and Dr. T. D. Soota, Deputy Director and Superintending Zoologist respectively for their encouragement.

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Bull. zool. Nom., vol 39, pt 1, March 1982

INDODORYLAIMUS ALI & PRABHA, 1974 (NEMATODA, DORYLAIMIDA): PROPOSED DESIGNATION OF A TYPE SPECIES BY USE OF THE PLENARY POWERS. Z.N.(S.) 2335

By Qaiser H. Baqri (*Zoological Survey of India, 27 Jawaharlal Nehru Road, Calcutta-700016, India*)

The purpose of this application is to provide a valid type species for the genus *Indodorylaimus* Ali & Prabha, 1974 because the originally designated type species was misidentified. The facts are as follows.

2. Yeates, 1970, described *Thornenema wickeni* from female specimens only. Ali & Prabha, 1974, described a population collected in India consisting of both sexes, and misidentified it as *T. wickeni*. They described the tails of the males as similar to those of the females.

3. As the male and female tails are dissimilar in *Thornenema* Andrássy, 1959, Ali & Prabha, 1974, proposed a new genus *Indodorylaimus* and designated *T. wickeni* as the type species.

4. For the present study, the type material of *Thornenema wickeni* was borrowed from the Rothamsted Experimental Station, and Ali & Prabha's material misidentified as *T. wickeni* was made available by the Museum voor Dierkunde, Rijkuniversiteit, Ghent, Belgium. A comparative study showed that the type specimens of *T. wickeni* differ from Ali & Prabha's specimens in the following characters: the lip region is narrower and less sclerotised, the amphids are differently shaped. In the paratypes, the cuticle is finely striated and the expanded part of the oesophagus is not highly muscular, as against the coarsely striated cuticle and highly muscular expanded basal part of the oesophagus in Ali & Prabha's specimens. The vulva and vagina are also differently shaped. This shows clearly that the specimens on which *Indodorylaimus* Ali & Prabha, 1974 was based were misidentified. The species that was before Ali & Prabha has no valid name. The name *Indodorylaimus elongatus* is here proposed for it.

5. The International Commission on Zoological Nomenclature is therefore asked:

(1) to use its plenary powers to set aside all designations of type species hitherto made for the genus *Indodorylaimus* Ali & Prabha, 1974 and to designate *Indodorylaimus elongatus* Baqri, 1982, as type species of that genus;

(2) to place the generic name *Indodorylaimus* Ali & Prabha, 1974 (gender: masculine), type species,

Indodorylaimus elongatus Baqri, 1982, by designation under the plenary powers in (1) above, on the Official List of Specific Names in Zoology;

(3) to place the specific name *elongatus* Baqri, 1982, as published in the binomen *Indodorylaimus elongatus* (specific name of type species of *Indodorylaimus* Ali & Prabha, 1974) on the Official List of Specific Names in Zoology.

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ADDITION TO THE PROPOSAL TO DESIGNATE A TYPE SPECIES FOR *INDODORYLAIMUS* ALI & PRABHA, 1974 (NEMATODA, DORYLAIMIDA) BY USE OF THE PLENARY POWERS. Z.N(S.)2335.

(see vol. 39, pp. 57–58)

By Qaiser H. Baqri (*Zoological Survey of India, 27 Jawaharlal Nehru Road, Calcutta-700016, India*)

The purpose of this application is to designate a lectotype for the species *Indodorylaimus elongatus* Baqri, 1982. The facts are as follows:

1. Baqri, 1982, proposed a new species, *Indodorylaimus elongatus*, to represent the species misidentified by Ali & Prabha, 1974, when they established the new genus *Indodorylaimus*. Unfortunately the species was named without designating a holotype and not following the other practices recommended in the Code under Recommendations 72A, 72C, 74B and 74C.

2. Out of 81 females and 4 males misidentified by Ali & Prabha, 1974, 7 females and one male were made available by the Museum voor Dierkunde, Rijksuniversiteit, Gent, Belgium. The remaining specimens of the series under the custody of the authors are not traceable. One of the available specimens has been designated as lectotype. The measurements of the lectotype and paralectotypes are given below:

Lectotype female: L = 1.11mm; a = 23; b = 5.2; c = 6.5; V = $^{10}37^{15}$.

Paralectotype females (n = 6): L = 1.05–1.15mm; a = 22-23; b = 5.0–5.4; c = 5.8–6.8; V = $^{0.6-0.9}34-40^{13-13}$.

Paralectotype male (No. 1): L = 1.08mm; a = 22.5; b = 5.0; c = 5.8; T = 36

3. The description and illustrations of *Indodorylaimus wickeni* provided by Ali & Prabha, 1974, and the illustrations of Ali & Prabha's misidentified specimens by Baqri & Jana, 1980 are sufficient for identification.

4. The lectotype along with the 6 paralectotype females mounted on slide PMJ/57/1.3 and a single male on slide PMJ/57/1.2 have been deposited in the nematode collection of the Museum voor Dierkunde, 35 Ledeganckstraat, Gent, Belgium.

5. Type habitat and locality: collected by Miss M.J. Prabha from soil around roots of *Luffa acutangula* Roxb. from Badanpur, district Aurangabad, Maharashtra, India.

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CHARACTERS TO BE OBSERVED AND CONSIDERED AT THE SPECIFIC LEVEL IN THE TAXONOMY OF DORYLAIMINA (NEMATODA)

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Apart from hasty decisions and observations, most of the confusions in the systematics of nematodes at the generic and specific level are due to inadequate descriptions and illustrations. While suggesting the data to be considered for the description of a new species of nematode, Goodey (1959) stated, "Many descriptions published today lack certain details which, although when described may not appear important, nevertheless give a fuller and more rounded picture of the species and may later become of importance." Goodey's (l. c.) outline for the description of a new species of nematode is out-dated now because the standards applicable to the different groups of nematodes are entirely different. A worker has also to be careful in using correct terminology.

The present paper deals specifically with nematodes belonging to the suborder Dorylaimina. Apart from the de Manain formula, the following characters should be taken into consideration while describing a new species and/or genus.

Body shape—Natural posture upon relaxation or fixation.

Cuticle—Thickness below lip region, mid-body and at tail regions ; smooth or striated, in case of striations-fine, distinct or coarse ; presence or absence of longitudinal lines in cuticle assists in the identification of various taxa in the suborder Dorylaimina. In some publications the longitudinal lines have been confused with somatic musculature, resulting in erroneous identifications. The presence of such lines or ridges may be observed by focussing at the uppermost surface of the cuticle. The number of longitudinal lines is also an important taxonomic character at the specific level ; these longitudinal lines can be correctly counted only in the transverse section through mid-body.

Body pores—The exact number of dorsal, ventral and lateral body pores should be reported region-wise, e. g., in the neck region, intestinal region, and tail.

Lateral chords—Nature ; width in relation to corresponding body-width near middle ; region-wise number and arrangement of glandular organs, if present.

Lip region—Offset or contiuous, well offset or slightly offset ; wider or narrower than adjoining body ; general shape ; width at base of neck divided by lip region-width = A ; lip region-width divided by lip region-height = B : shape of lips ; arrangement of labial papillae. If disc., liplets or sclerotized pieces are present ; these should be illustrated and described accurately.

Amphids—Shape of amphidial pouch (fovea) ; absolute width of amphidial slit, and its ratio with corresponding body-width ; position from anterior extremity. Absolute position of sensillar pouches (fuses) from amphidial slit.

Stoma—Size and shape of stomatal cavity is very important ; every special differentiation should be described and illustrated in detail.

Teeth & Tooth—General appearance or shape, position and length.

Odontostyle—General appearance or shape, absolute length and ratio with head-width, width in relation to body cuticle at that level ; length of dorsal oblique aperture and ratio with odontostyle length ; any unique feature.

Guiding ring—According to Goodey (1961) and Coomans (1963) the guiding apparatus has the same basic structure in all dorylaims, i. e., comprising the fixed sclerotized ring (weak or strong) and attached guiding sheath. Since the position of the fixed guiding ring is as table and important character, it should be mentioned in micrometres from anterior end as well as the ratio with the head-width. When the fixed ring is posteriorly situated, the sheath is folded even when the odontostyle is fully retracted, hence the guiding ring appears "double".

Odontophore—General appearance, any special feature like curved or knobbed etc. ; distinctly or poorly demarcated from oesophageal lining ; absolute length and ratio with odontostyle length.

Oesophagus—If there is any difference between the tissues of anterior slender and basal expanded parts of oesophagus ; the anterior slender part either expands gradually or suddenly

to form the basal expanded part or offset by a constriction ; basal expanded part as percentage of total oesophageal length or neck length. In some groups, the basal or enlarged part of oesophagus is surrounded by a weak or strong muscular sheath. The muscle bundles forming the sheath may be straight and parallel to the longitudinal axis of the oesophagus, slightly twisted or spiral. When spiral, the arrangement is either clockwise or anti-clockwise. The difference in the arrangement of muscle bundles is of taxonomic importance. Thus, all efforts should be made to illustrate and describe the exact arrangement.

Loof and Coomans (1970) have shown that the location of oesophageal gland nuclei and their orifices is a constant feature in different groups. It is, therefore, suggested that special care should be taken in measuring and calculating the values of all oesophageal glands (usually 5, sometimes 3) and their orifices

The exact shape and size of the oesophago-intestinal junction or cardia should be described. Sometimes the cardia is enveloped by intestinal tissue which may obscure its exact shape.

The presence or absence of an oesophago-intestinal disc and of cardiac glands is also important.

Above the nerve ring sometimes there are two small subventral structures, probably sensory organs, in the cuticular lining of the oesophagus, called "endolids" ; their presence and development should be noted.

Hemizonid—If visible, conspicuous or inconspicuous and position.

Nerve ring—Absolute position from anterior end in micrometres and percentage calculated from total oesophageal length.

Intestine :—Opacity and size of granules.

Preretum :—The length in micrometres and its ratio with the anal body-width. Microvilli, if visible in lumen, should be illustrated with exact length and width. Occasionally a sphincter-like structure is present at intestine-prerectum junction. Sometimes a constriction is visible at the intestine-prerectum junction. Presence of postrectal sac is also important from taxonomic point of view.

Rectum :—Absolute length in micrometres and its ratio with anal body-width. The presence of rectal glands should also be mentioned, if visible.

FEMALE

Vulva —Position ; whether protruded or flush with body or situated in a depression ; slit-like, oval or pore-like ; if slit-like-transverse or longitudinal.

Vagina :—Shape and thickness of wall ; absolute length and ratio with corresponding body-width ; sclerotized distally or not ; sphincter-like structures encircling the vaginal walls. Special care should be taken in sketching the exact shape of vagina because of its taxonomic value.

Genital tract :—Didelphic or monodelphic. In case of monodelphic—prodelphic or opisthodelphic, trully monodelphic or pseudomonodelphic ; in pseudomonodelphic species the length of uterine sac in micrometres and its relationship with the corresponding body-width.

Ovejector : Its presence and development should be indicated.

Uterus : Shape and length ; differentiation between distal glandular and proximal muscular part should be noted ; the presence or absence of "Z" organs or pseudo—"Z" organs which are globular or sclerotized bodies of unknown origin in the lumen of the median uterus.

Oviduct : Shape and length in relation to uterus ; proximal expanded part well or weakly developed. The oviduct and uterus are separated by sphincter that may be well or weakly developed.

Ovary : Reflexed once or twice ; the number of rows of oogonia or oocytes in growth zone and germinal zone.

Sperm : Presence or absence should be noted ; place of storage ; size and shape of spermatozoa.

Egg : Size, shape and number.

Tail :—Shape ; absolute length, ratio with anal body-width ; the number and distribution of caudal pores ; occassionally the saccate bodies are also present.

MALE

Male gonad :—The male gonad should be illustrated/described with the following details : Testes (dorylaimina nematodes are diorchic) ; gonoduct eventually differentiated in a vas deferens and ejaculatory duct ; ejaculatory glands, if present ; spetmatozoa with exact shape and length.

Spicules :—The shape and exact length along the median line is very important from taxonomic point of view, the length should further be indicated in relation to anal body-width.

Lateral guiding pieces :—Shape and absolute length in micrometres.

Adanal and Ventromedian Supplements :—The number ; spaced, contiguous, or arranged in fascicles ; if spaced, regularly or irregularly ; if in fascicles, the number of fascicles and number of supplements in each fascicles. The space between adanal and first ventromedian supplement ; the position of the last supplement should also be mentioned.

Subventral papillae :—The exact number, arrangement and the area occupied.

Copulatory muscles :—The exact number and the area occupied.

Tail :—Similar or dissimilar to female ; shape ; absolute length and ratio with anal body-width ; the number and distribution of caudal pores. Any other information.

JUVENILES

Juveniles, if available, should also be included in descriptions and illustrations.

Characters to be considered (apart from body dimensions) : Similar or dissimilar to adults in general shape and morphology ; length of active odontostyle in micrometres length of replacement odontostyle in micrometres ; distance of replacement odontostyle tip from anterior extremity in micrometres ; length and width of gonodial primordium in micrometres. Tail shape and length.

Note : The microscope, which is the most important instrument for a taxonomist, should have a good resolution and illumination arrangement. Apart from this, a worker should use this instrument optimally to observe the minute characters. A sharp pointed pencil should

be used to maintain the accuracy of curvatures and exact shape, viz. head shape, amphids, odontostyle, vagina, spicules, lateral guiding pieces, etc.

Some useful publications on the subject (descriptions, illustrations, measurements and diagnostic tables, terminology etc. have been referred below.

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NEMATODES FROM WEST BENGAL (INDIA) XI
STUDIES ON THE SPECIES OF THE SUPERFAMILY LEPTONCHOIDEA (DORYLAIMIDA)

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The eleventh paper of the series "Nematodes from West Bengal (India)" reports 11 species belonging to the Superfamily Leptonchoidea (Thorne, 1935) Ferris, 1971 collected during the last six years (1975-1980) in West Bengal. Baqri and Khera (1979) have already reported five species of the genus *Dorylaimoids* Thorne and Swanger, 1936. The repo ted species have been identified under the following genera : *Proleptonchus* Lordello, 1955 ; *Tyleptus* Thorne, 1939 ; *Basirotyleptus* Jairajpuri, 1964 ; *Dorylaimoides* Thorne and Swanger, 1936 ; and *Morasia* Baqri and Jairajpuri, 1969. Out of eleven, the following four species have been described as new : *Basirotyleptus minimus* n. sp., *Dorylaimoides subhasi* n. sp., *Dorylaimoides filicaudatus* n. sp., and *Morasia bengalensis* n. sp.

The specimens were killed and fixed by hot 4% formalin and mounted in anhydrous glycerine. All the type specimens have been registered and deposited in the National Zoological Collections at Zoological Survey of India, Calcutta.

GENUS : PROLEPTONCHUS Lordello,1955

Proleptonchus clarus Timm, 1964

(Fig—1)

Measurements :

Females (5) : L=1.62-1.83 mm ; a=33-41 ; b=7.5-8.5 ; c=82-92 ; V= $\frac{16\text{-}19}{56\text{-}59}$ 5-7.

Males (4) : L=1.60-2.08 mm ; a=35-43 ; b=7.6-10.6 ; c=80-92 ; T=34-58.

Description : Body slightly curved ventrally upon fixation. Cuticle coarsely striated transversely ; its thickness about 2μm at mid-body and 5-6μm at tail. Lateral chords granular, 1/ 9th-1/ 7th body-width near middle. Lateral, dorsal and ventral body pores indistinct

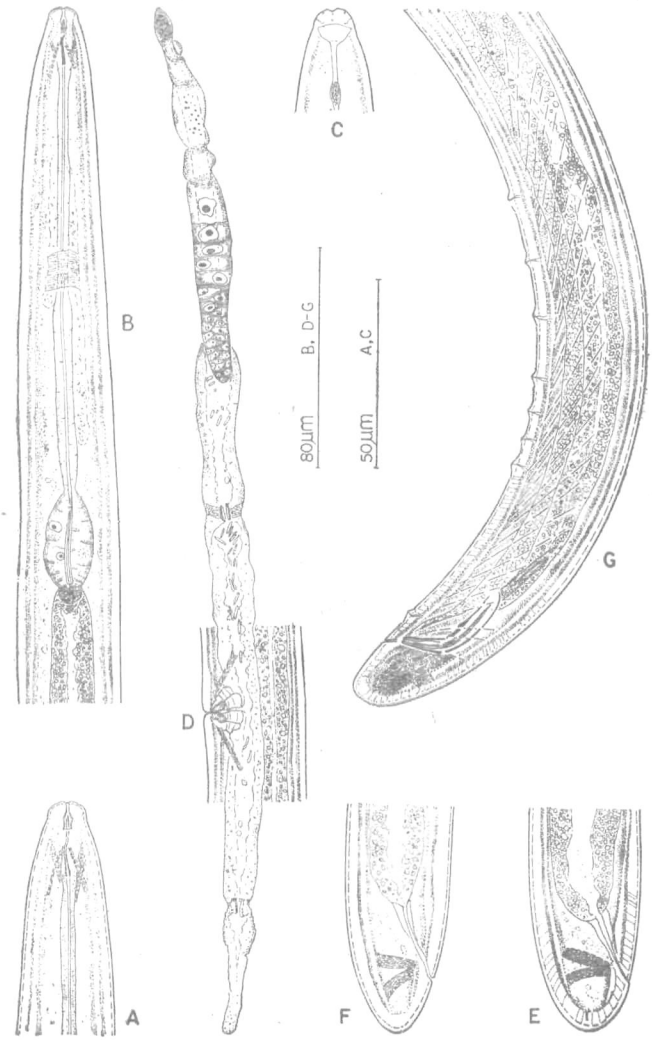

Fig. 1

Proleptonchus clarus Timm, 1964 : A. Anterior end. B. Anterior end showing oesophageal region. C. Surface view of anterior end. D. Female reproductive system. E. Posterior region of female F. Variation in tail shape. G. Posterior region of male.

Lip region slightly offset from adjoining body, 1/3.7-1/3.4 of body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying 7-8 μm or 78-82% of the corresponding body-width and about 4 μm from anterior end.

Odontostyle 7-8 μm or 0.6-0.7 lip region-width long, aperture about 2 μm or 25-28% of odontostyle length. Guiding ring 7-8 μm or 0.7-0.8 lip region-width from anterior end. Odontophore 9-11 μm or 1.3-1.5 times the odontostyle length. Anterior slender part of oesophagus non muscular while basal expanded part muscular. Basal expanded part of oesophagus occupying 17-18% of neck region. Nerve ring 96-101 μm or 45-48% of the neck region from anterior end. Oesophago-intestinal disc absent. Cardia globular, 8-10 μm long, enveloped by intestinal tissue. Prerectum 151-204 μm or 5-7 anal body-widths long. Rectum 27-29 μm or 0.8-0.9 anal body-width long.

Vulva a transverse slit. Vagina extending 19-20 μm or about 1/2.5-1/2.1 of the corresponding body-width, surrounded by sphincter, moderately sclerotized distally. Female reproductive system prodelphic. Posterior uterine sac 98-129 μm or 2.0-2.5 times the corresponding body-widths long. Uterus and oviduct separated by sphincter; oocytes arranged in a single row, double row and then in multiple rows at the growth region.

Tail short, bluntly rounded, 19-21 μm or 0.6-0.7 anal body-width long, with one caudal pore on each side. In one female the shape of the tail is somewhat bluntly conoid (Fig.-1, F).

Male : Similar to female in general shape and morphology except the more ventrally curved posterior region and the male reproductive system. Spicules 42-45 μm or 1.6-1.8 anal body-widths long. Lateral guiding pieces rod-shaped, 12-14 μm long. The supplements consist of an adanal pair and 7-8 irregularly spaced ventromedians, the first four are spaced at shorter distance than last three or four which are widely spaced. The first ventromedian supplement situated out side the spicular range. Subventral papillae not distinct. Copulatory muscles 23-27, reaching anterior to the supplement region. Spermatozoa elliptical, 3-5 μm long. Prerectum 151-188 μm or 6-8 anal body-widths long. Tail similar to female, 20-22 μm or about 0.8 anal body-width long.

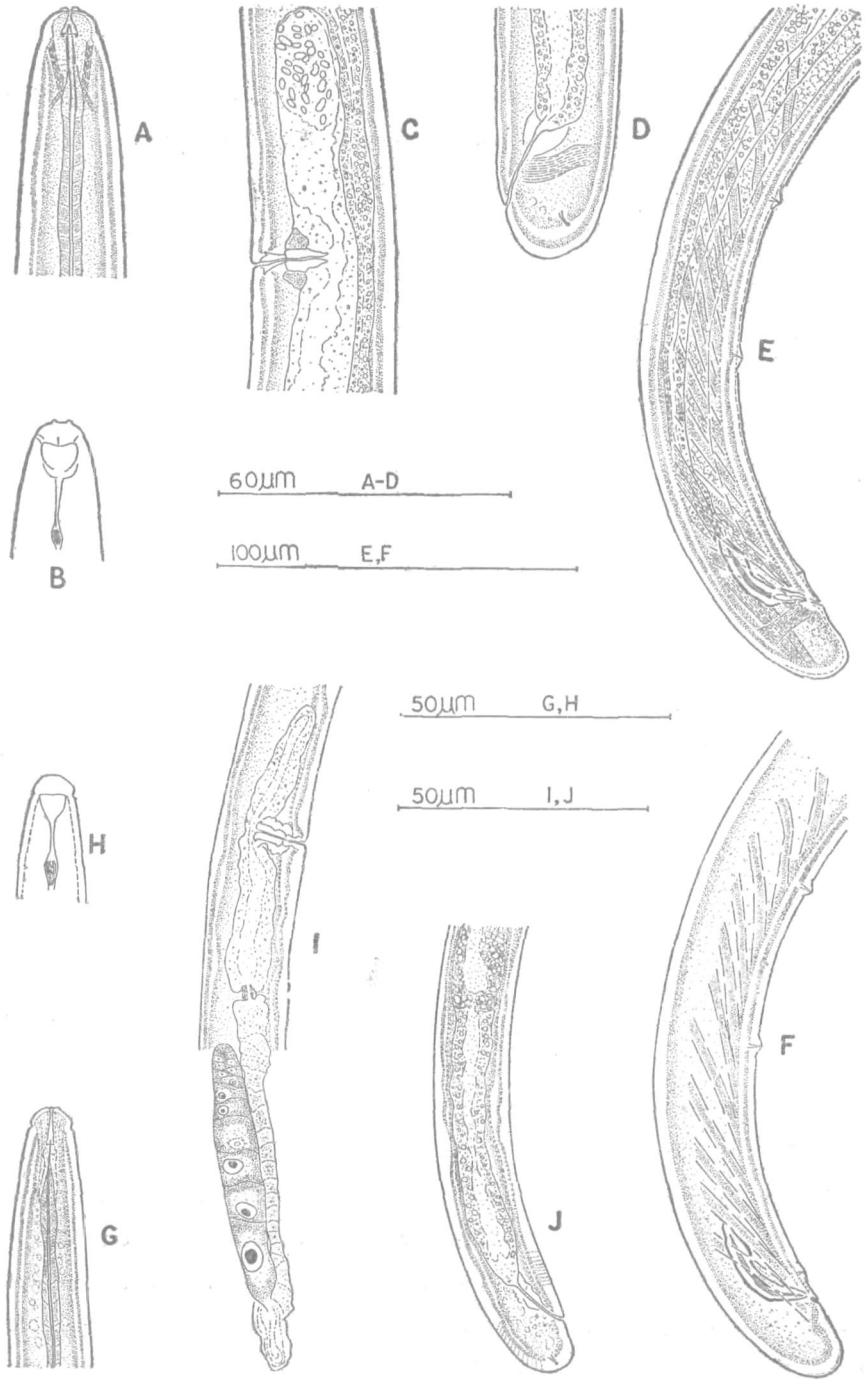

Fig. 2

A-F : *Tyleptus projectus* Thorne 1939 A. Anterior end. B. Surface view of anterior end. C. Vulva-vagina region. D. Posterior region of female, E Posterior region of male. F. Posterior region of male showing copulatory muscle. G-J : *Basirotyleptus minimus* n. sp. : G. Anterior end H. Surface view of anterior end. I. Female reproductive system. J. Posterior region of female.

Remarks : The present study reveals that the Indian population fits well with the original description of *P. clarus* given by Timm (1964), except the posterior sexual branch which ranges from 2.0-2.5 times the corresponding body-width in the present population against less than two body-widths as reported by Goseco **et al** (1974) in their key to species of *Proleptonchus*.

Habitat and locality : Soil around roots of paddy, *Oryza sativa* from Abujhati, block Jamalpur, District Burdwan

GENUS : TYLEPTUS Thorne, 1939

Tyleptus projectus Thorne, 1939

(Fig-2, A-F)

Measurements :

Females (4) : L=0.90-1.01 mm ; a=31-35 ; b=4.1-4.7 ; c=82-113 ; V=$^{4-6}_{30-31}$ $^{26-27}$

Males (5) : L=0.94-1.00 mm ; a=32-34 ; b=4.3-4.6 ; c = 56-59 ; T=59-63

Description : Body slightly curved ventrally. Cuticle striated transversely. Lip region demarcated by a slight depression. Liplets prominent. Amphids stirrup-shaped, occupying 6-7 μm or 59-63% of the corresponding body width. Guiding ring about 5 μm from anterior end. Odontostyle 8-9 μm long. Odontophore 10-13 μm long. Basal expanded part of oesophagus occupying 14-18% of the total oesophageal length. Vulva transverse ; vagina 14-17 μm long. Female reproductive system mono-opisthodelphic. Anterior uterine sac 45-59 μm or 1.5-2.0 vulva body-width long, sometimes filled with sperms. Prerectum 83-108 μm or 4-5 anal body-widths long. Rectum 20-25 μm long. Tail hemispheroid with sunken cuticle at terminus, 9-11 μm long ; caudal pores one to two on each side.

Male : Similar to female in general morphology. Spicules 30-32 μm medially. In addition to an adanal pair, ventromedian supplements 2-3. The first ventromedian supplement situated far anterior to cloacal opening. Copulatory muscle spaced, 11-13, occupying the supplement region. Tail bluntly rounded, 18-20 μm long.

Remarks : Goseco et al (1974) reported a male of *T. projectus* from Martin State Forest, Indiana, and mentioned that the spicule is 43 μm long. However, in the present study we have noticed that the spicules measure 30-32 μm long along the curved median line.

Habitat and Locality : Soil around roots of Banana, *Musa* sp., from Collegepara, Jalpaiguri, District Jalpaiguri.

GENUS : BASIROTYLEPTUS Jairajpuri, 1964

Basirotyleptus minimus n. sp.

(Fig.—2, G-J)

Measurements :

Holotype (Female) : L=0.48 mm ; a=27 ; b=5.2 ; c=60 ; V= $\frac{5}{41}\,\frac{21}{}$

Paratypes (10 Female) : L=0.47-0 51 mm ; a=21-27 ; b = 5.2-5.6 ; c = 53-60 ; V = $\frac{3\text{-}5}{37\text{-}41}\,\frac{17\text{-}26}{}$

Description : Body slightly curved ventrally upon fixation, tapering slightly towards both ends. Cuticle coarsely striated throughout the body ; about 2 μm thick at mid-body and 3-4 μm at tail. Refractive elements not distinct. Dorsal, ventral and lateral body pores indistinct. Lateral chords about 1/4th-1/3rd of body-width near mid-body.

Lip region distinctly offset from body, 1/2.8-1/2.2 body-widths at base of oesophagus. Amphids stirrup-shaped, apertures 4-5 μm wide or occupying 58-63% of the corresponding body-width and about 4 μm from anterior end. Sensillar pouches 12-14 μm from amphidial aperture.

Odontostyle typical to the genus, needle-like, 6-7 μm or 0.9-1.0 head-width long. Guiding ring 6-7 μm or about one lip region-width from anterior end. Odontophore 9-11 μm or 1.4-1.5 times the odontostyle length. Basal expanded part of oesophagus occupies 16-19% of the total oesophageal length. Nerve ring at 50-54 μm or at 56-59% of the

neck region from anterior end. Locations of oesophageal gland nuclei and their orifices not distinct. Cardia small, hemispherical.

Vulva a transverse slit, vagina 10-12 μm or about half vulval body-width long. Female reproductive system mono-opisthodelphic. Ovary reflexed ; oocytes arranged in a single row except at the growth region. Anterior uterine branch 17-27 μm or 0.8-1.4 vulval body-width long. Oviduct and uterus separated by sphincter. Prerectum 36-50 μm or 3.0-4.5 anal body-widths long. Rectum 12-15 μm or 1.0-1.2 anal body-widths long.

Tail small, hemispherical, 8-10 μm or less than one anal body-width long, with one to two caudal pores on each side.

Male : Not found.

Type Habitat and Locality : Soil around roots of paddy, *Oryza sativa* from Teen Battimore, Siliguri, District Darjeeling.

Type Specimens : Collected by Dr. Q. H. Baqri in ovember, 1975 ; holotype along with other paratypes mounted on slide Reg. No. WN 450, Z.S.I.

Differential Diagnosis : *Basirotyleptus minimus* n. sp , comes close to *B. basiri* Jairajpuri, 1964 and *B. upicus* Ahmad & Jairajpuri 1979. From the former it differs in having shorter body and odontostyle (L=0.58-0.67 mm and odontostyle 12-15 μm in *B. basiri*). From *B. upicus* the present new species differs in having shorter body (L=0.77-0 85 mm in *B. upicus*), coarsely striated cuticle (cuticle finely striated in *B. upicus*) ; shorter odontostyle and anterior uterine sac (odontostyle 13-15 μm and anterior uterine branch 2 vulval body-width in *B. upicus*).

GENUS : DORYLAIMOIDES Thorne & Swanger, 1936

Dorylaimoides micoletzkyi (de Man, 1921) Thorne & Swanger, 1936

(Fig.-3, A-D)

Measurements :

Females (2) : L=1.27-1.30 mm ; a = 36.39 ; b = 5.8-6.3 ; c = 21-23 ; V = $\frac{12\text{-}13 \quad 13\text{-}14}{40\text{-}42}$

Male (1) : L = 1.26 mm ; a = 38 ; b=6.0 ; c=22 ; T = 59

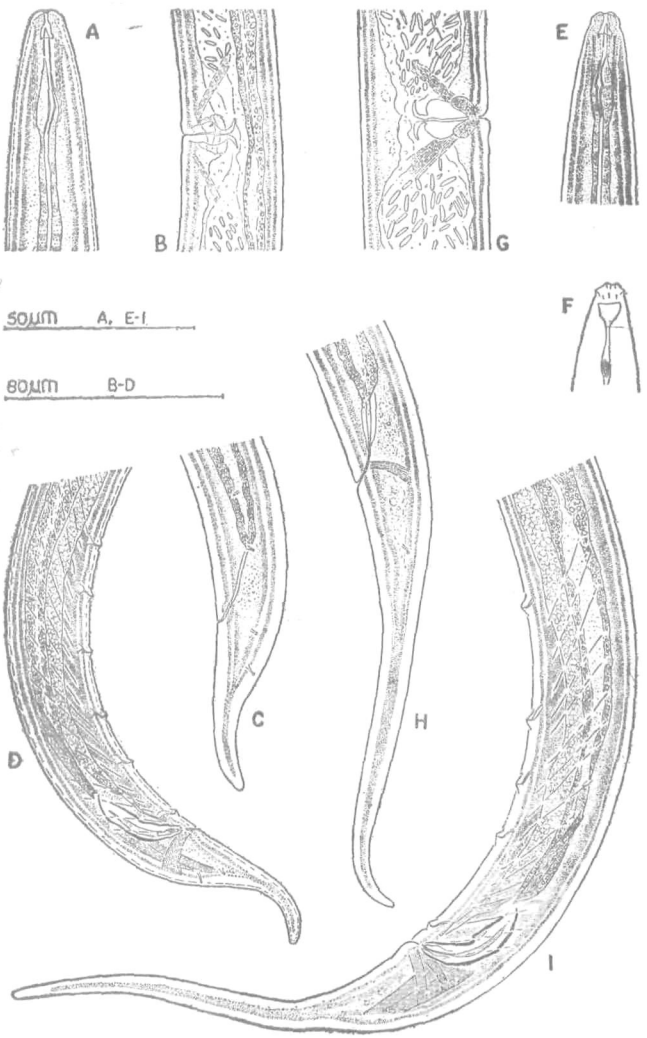

Fig. 3

A-D : *Dorylaimoides micoletzkyi* (de Man, 1921) Thorne & Swanger, 1936 : A. Anterior end. B. Vulva-Vagina region. C. Posterior region of female. D. Posterior region of male. E-I : *Dorylaimoides parvus* Thorne & Swanger, 1936 : E. Anterior end. F. Surface view of anterior end. G. Vulva-vagina region. H. Posterior region of female. I. Posterior region of male.

Description : Body ventrally arcuate. Cuticle finely striated. Lateral chord 1/8th-1/7th of body-width near middle. Head slightly constricted. Amphids stirrup-shaped, 6-7 μm wide Odontostyle 10-12 μm dorsally and 7-9 μm long ventrally. Odontophore typical, 16-17 μm long. Guiding ring about 7 μm from anterior end. Basal expanded part of oesophagus occupying 25-27% of oesophageal length. Vulva transverse ; vagina 17-19 μm long surrounded by sphincter muscles. Female reproductive system amphidelphic, typical. Prerectum about 7 anal body-widths long. Tail elongate conoid, 55-61 μm long ; distal end bent dorsally with rounded terminus ; caudal pores two to three on each side.

Male : Spicules 36 μm long medially. Lateral guiding pieces 8 μm long. In addition to adanal pair, 5 ventromedian supplements spaced irregularly. Tail 57 μm long with two caudal pores on each side.

Habitat and Locality : Soil around roots of Jack fruit (*Artocarpus* sp.) and Pineapple (*Ananus* sp ,) from Chakchaka, District Coochbehar.

Dorylaimoides parvus Thorne and Swanger, 1936

(Fig -3, E-I)

Measurements :

i) **Garaghata Population :**

Females (3) : L = 1.47-1.56 mm ; a=42-45 ; b=7.1-8.0 ; c=12-14 ; V= $\begin{matrix}8\text{-}11 & 9\text{-}10\\ & 32\text{-}40\end{matrix}$

Males (4) : L=1.35-1.43 mm ; a=42-45 ; b=6.7-7.7 ; c = 12-13 ; T=49-54

ii) **Kantapur Population :**

Females (2) : L = 1.32-1.33 mm ; a = 40 ; b=7.2-7.5 ; c = 11 ; V= $\begin{matrix}10\text{-}11 & 10\\ 40\text{-}45 & \end{matrix}$

Males (2) : L=1.25-1.39 mm ; a=39-46 ; b=6.8-7.3 ; c = 11-12 ; T=56-57

iii) **Pamra Population :**

Females (3) : L=1.29-1.41 mm ; a=36-44 ; b=6.7-7.4 ; c=12-13 ; V= $\begin{matrix}10\text{-}11 & 11\text{-}12\\ 37\text{-}41 & \end{matrix}$

Male (1) : L=1.25 mm ; a=39 ; b=6.2 ; c=13 ; T=55

Description : Body curved ventrally. Cuticle finely striated transversely. Lip region slightly offset. Amphids stirrup-shaped, 6-7 μm wide. Odontostyle 6-7 dorsally and 5-6 μm ventrally. Guiding ring 6-7 μm from anterior end. Odontophore 16-18 μm long. Basal expanded part of oesophagus occupying 26-31% of the oesophageal length. Vulva a transverse slit. Female reproductive system amphidlphic, typical. Sperms present in the uteri. Prerectum 80-136 μm long. Tail elongate with rounded terminus, 108-126 μm or 5.4-7.0 anal body-widths long, with one to two caudal pores on each side.

Male : Similar to female in general morphology. Spicules 27-32 μm long when measured along curved median line. Lateral guiding pieces 7-9 μm long. In addition to the adanal pair, there are 3-5 irregularly spaced ventromedian supplements. Tail 94-114 μm or 4.2-5.6 anal body-widths long. Caudal pores not distinct.

Remarks : Goseco et al (1976) differentiated *D. parvus* from *D. elaboratus* Siddiqi, 1965 in having shorter tail (c=11-13 against 7-10 in *D. elaboratus*), different arrangement and number of ventromedian supplements. The present study also reveals that first ventromedian supplement in *D. parvus* is situated much antarior to the spicular region whereas in *D. elaboratus* it is located near the middle of the spicular region.

Habitats and Localities : i) Soil around roots of paddy, *Oryza sativa* from Garaghata, block Memari, district Burdwan. ii) Soil around roots of paddy, *Oryza sativa* from Kantapur, block Memari, district Burdwan. iii) Soil around roots of paddy, *Oryza sativa* from Pamra, block Boursul, district Burdwan.

Dorylaimoides leptura Siddiqi, 1965

(Fig.-4, A-C)

Measurements :

Females (2) : L=1.78-1.80 mm ; a=45-47 ; b=7.2-7.4 ; c=9-10 ; $V=\frac{10\ \ 10}{35\text{-}36}$

Description : Body slightly curved ventrally. Cuticle finely striated transversely. Lip

region offset by a constriction. Amphids cup-shaped, about 5 μm wide. Odontostyle 6-7 μm long dorsally and about 5 μm long ventrally. Guiding ring 6-7 μm from anterior end. Odontophore 16-17 μm long. Basal expanded part of oesophagus 31-33% of the oesophageal length. Vulva a transverse slit. Vagina 20-22 μm long with moderately sclerotized distal region. Female reproductive system amphidelphic. Prerectum 235-270 μm or about 12-14 times the anal body-width. Tail elongate-filiform, about 8-10 anal body-widths long, with two caudal pores on each side.

Habitat and Locality : Soil around roots of onion, *Allium* sp., from Kashipur, block Bolpur, District Birbhum.

Dorylaimoides arcuicaudatus Baqri & Jairajpuri, 1969

(Fig -4, D-F)

Measurements :

Females (2) : L=0.68-0.75 mm ; a=25-27 ; b=4.7-5.2 ; c=18-20 ; V= $\begin{matrix}14\text{-}17 & 16\text{-}18 \\ & 48\text{-}49\end{matrix}$

Description : Body ventrally arcuate. Cuticle finely striated transversely. Lip region offset. Amphids stirrup-shaped, about 5 μm wide. Odontostyle 9-10 μm long dorsally and about 7 μm long ventrally. Guiding ring 5-6 μm from anterior end. Odontophore 12-14 μm long Basal expanded part of oesophagus occupies 26-29% of oesophageal length. Vulva transverse. Female reproductive system amphidelphic. Sperms present in the uteri. Prerectum 49-55 μm or 3-4 anal body-widths long. Tail ventrally arcuate-conoid with rounded terminus, 34-43 μm or 2.4-2.7 anal body-widths long.

Remarks : The present specimens differ from the original description of *D. arcuicaudatus* given by Baqri and Jairajpuri (1969) only in having shorter body (L=1.2-1.4 mm in type specimens).

Habitat & Locality : Soil around roots of paddy, *Oryza sativa* from Majherpara, block Boursul, District Burdwan.

Fig. 4

A-C : *Dorylaimoides leptura* Siddiqi, 1965 : A. Anterior end. B. Vulva-vagina region. C. Posterior region of female.
D-F: : *Dorylaimoides arcuicaudatus* Baqri & Jairajpuri 1969 D. Anterior end. E. Vulva-vagina region. F. Posterior region of female.
G-I: *Dorylaimoides parateres* Siddiqi, 1964. G. Anterior end. H. Vulva-vagina region. I. Posterior region of female.

Dorylaimides parateres Siddiqi, 1964

(Fig.-4, G-I.)

Measurements :

Females (3) : L=1.44-1.62 mm ; a=37-39 ; b=6.7-7.3 ; c=58-60 ; V=$^{9\text{-}10}_{44\text{-}46}$ $^{10\text{-}11}$

Description : Body ventrally curved. Cuticle with fine transverse striation. Lip region slightly offset. Amphids stirrup-shaped, 6-7 μm wide. Odontostyle 14-15 μm long dorsally and 9-11 μm long ventrally. Odontophore 17 μm long. Guiding ring 8-9 μm from anterior end. Basal expanded part of oesophagus occupying 24-26% of the oesophageal length. Vulva transverse ; vagina 19-21 μm long, surrounded by sphincter muscles Female reproductive system amphidelphic. Uteri filled with sperms. Prerectum 6-7 anal body-widths long. Rectum slightly more than one anal body-width long. Tail 25-28 μm long, obtusely rounded with three caudal pores on each side.

Remarks : Goseco et al (1976) have expressed their doubt that the male of *D. parate-es* reported by Baqri and Jairajpuri (1969) comes more close to *D. indicus* Jairajpuri, 1965. However, the presence of sperms in the uteri of the present specimens further confirms that *D. parateres* is a bisexual species.

Habitat and Locality : Soil around roots of unidentified grasses, Coochbehar—Toofangunj Road, Toofangunj, District Coochbehar.

Dorylaimoides subhasi* n. sp.

(Fig -5)

Measurements :

Holotype (Female) : L=1.34 mm ; a=46 ; b=5.6 ; c=12 ; V=$^{4}_{36}$ ^{12}

Paratype (2 Females) : L=1.35-1.36 mm ; a=47-48 ; b=5.5-5.6 ; c=13 ; V=3 $^{10\text{-}11}_{34\text{-}36}$

Paratypes (3 Males) : L=1.19-1 27 mm ; a=48-51 ; b=5.1-5.3 ; c=20-23 ; T=56-59

(Named after Subhas Ghosh, Jt. Zool. Asst., Z. S. I., who collected the Sil Sample)

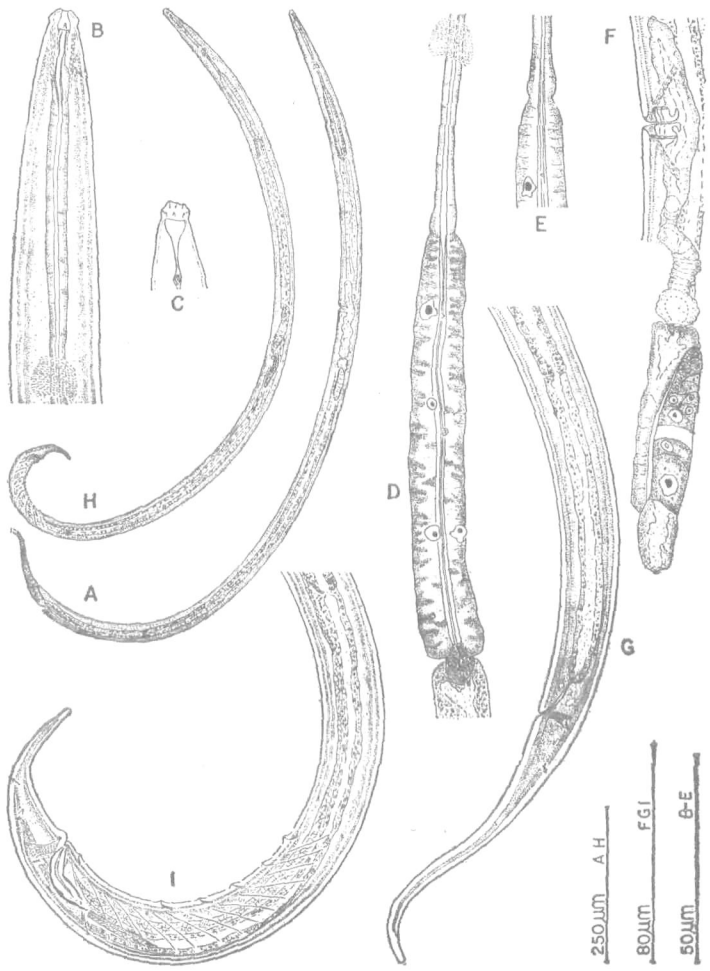

Fig. 5

Dorylaimoides subhasi n. sp.: A. Entire female. B. Anterior end. C. Surface view of anterior end. D. Basal expanded part of oesophagus. E. Constriction at the junction of anterior slender and basal expanded part of oesophagus. F. Female reproductive system. G. Posterior region of female. H. Entire male. I. Posterior region of male.

Description :—Body ventrally curved upon fixation and tapering gradually towards both ends. Cuticle finely striated transversely ; its thickness slightly more than 1 μm at mid-body and 2-3 μm at tail. Lateral chords 1/7th-1/6th of the body-width near middle. Lateral, dorsal and ventral body pores indistinct.

Lip region well offset by a constriction, slightly wider than adjoining body, 1/3.8-1/3.1 of body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying 5-6 μm or about 70% of the corresponding body-width and about 4 μm from anterior end. Sensillar pouches 14-15 μm from amphidial apertures.

Odontostyle measures 6-7 μm ventrally and 8-9 μm dorsally or 1.0-1.1 and 0.8-1.1 lip region-width long respectively ; slightly thicker than corresponding cuticular width ; aperture 2-3 μm or 28-33% of odontostyle length. Guiding ring 4-5 μm or about 0.6-0.7 lip region-width from anterior extremity. Odontophore 10-12 μm or 1.2-1.5 times the odontostyle length. Basal expanded part of oesophagus occupying 43-45% of the oesophageal length. Locations of oesophageal gland nuclei and their orifices as follows :

DO—62.1-65.2 S_1N_1—72-74 $S_2'N$—86-87

DN—63.2-64.8 S_1N_2—74-76 S_2O—87-88

DO-DN—1.10-1.15

K—82-84 K'—76-88

Nerve ring 86-92 μm or 37-40% of the neck region from anterior end. Cardia bluntly conoid, enveloped by intestinal tissue. Oesophago-intestinal disc absent. Prerectum 104-129 μm or 6.1-7.5 anal body-width long. Rectum 21-25 μm or 1.3-1.5 anal body-width long.

Vulva a transverse slit. Vagina 15-16 μm or extending inward about half of the corresponding body-width, surrounded by sphincter, with moderately sclerotized distal region. Female reproductive system mono-opisthodelphic. Anterior uterine sac 42-55 μm or 1.4-2.0 times the corresponding body-width. Oviduct and uterus distinctly separated by sphincter. Ovary reflexed, oocytes arranged in a single row, then in double row and in multiple rows at growth region. Sperm not seen.

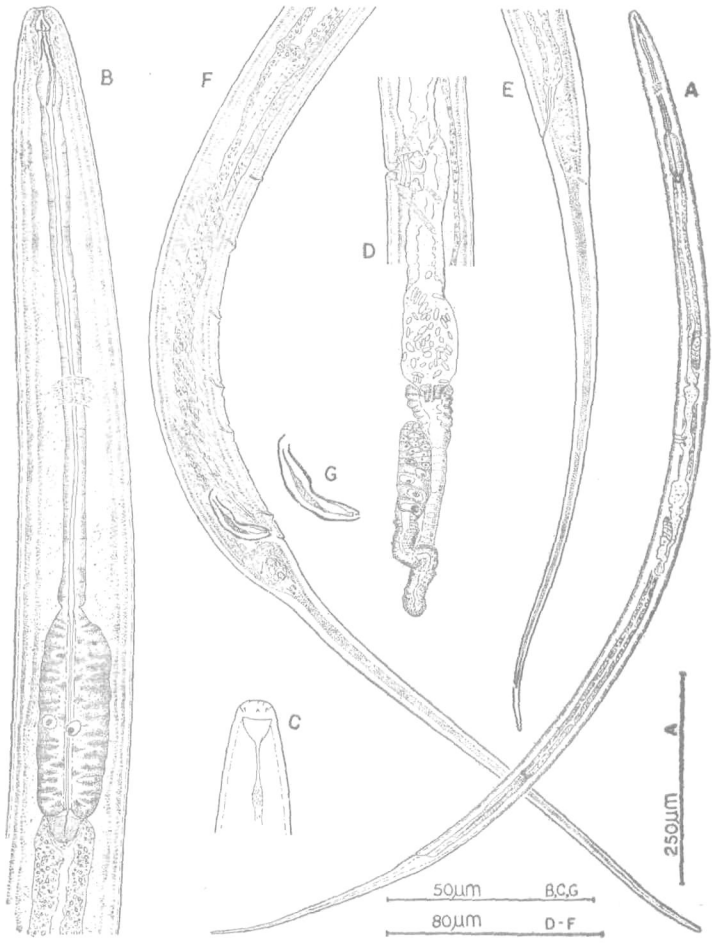

Fig. 6

Dorylaimoides filicaudatus n. sp. : A. Entire female. B, Anterior end showing oesophageal region. C. Surface view of anterior end. D. Female reproductive system showing posterior gonad. E. Posterior region of female. F. Posterior region of male.

Tail elongate-conoid, usually bent dorsally with rounded terminus, 106-110 μm or 6-7 anal body-widths long, with 2-3 caudal pores on each side.

Male : Similar to female in general shape and morphology except strongly curved posterior region and male reproductive system. Supplements consist of an adanal pair and 5-6 ventromedians, spaced more or less regularly : the first one situated at 2.3-2.4 anal body-widths from cloacal opening. Spicules 26-28 μm or about 1.5 anal body-width long. Lateral guiding pieces rod-shaped, 4-5 μm long. Prerectum 170-216 μm or 9-13 anal body-widths long.

Tail elongate-conoid, ventrally arcuate, with rounded terminus, 55-63 μm or 3.0-3.5 anal body-widths long. Caudal pores 3 on each side.

Type Habitat and Locality : Soil around roots of Chilli, *Capsicum* sp., from Beledanga, District Hooghly.

Type Specimens : Collected by S. Ghosh in June 1977 ; holotype along with 5 paratype mounted on slide Reg. No. WN 451, Z.S.I.

Differential Diagnosis : *Dorylaimodes subhasi* n. sp , comes close to *D. reversus* Thorne, 1964 ; *D. saueri* Baqri and Jairajpuri, 1969 and *D. constrictoides* Goseco et al, 1976 From *D. reversus* it differs in having differently shaped lip region, longer body and larger basal expanded part of oesophagus (L = 0.8 mm, basal expanded part of oesophagus occupying 25% of the oesophageal length in *D. reversus*). From *D. saueri* it differs in having longer body, larger basal expanded part of oesophagus, longer spicules and more number of ventromedian supplements in male (L=0.84-0.90 mm ; basal expanded part of oesophagus occupies 22-25% of oesophageal length ; spicules 19-22 μm and ventromedian supplements 2-3 in *D. saueri*). The present species also differs from both the above mentioned species by having a constriction at the junction of anterior slender and basal expanded part of oesophagus. From *D. constrictoides* the present new species differs in having differently shaped lip region, shorter spicules (spicules 31-33 μm in

D. constrictoides), number and arrangement of ventromedian supplements (ventromedian supplements 3 which are widely spaced in *D. constrictoides*).

Dorylaimoides Filicaudatus n. sp.

(Fig.-6)

Measurements :

Holotype (Female) : L=1.18 mm ; a=41 ; b=6 2 ; c=5.5 ; V= $\frac{10\ 11}{38}$

Paratype (2 Females) : L=1.00-1.31 mm ; a = 35-44 ; b = 5.5-6.9 ; c = 4.6-5.1 ; V= $\frac{11\text{-}15\ \ 12\text{-}15}{37\text{-}42}$

Paratype (3 Males) : L=0.91-1.23 mm ; a=42.46 ; b=5.2-6 7 ; c=5.3-6.9 ; T=45-50

Description : Body ventrally curved upon fixation, tapering slightly towards both extremities. Cuticle finely striated transversely ; its thickness about 2 μm at mid-body and 3-4 μm at tail. Lateral chords granular, 1/5th—1/4th the body-width near middle. Lateral, ventral and dorsal body pores indistinct.

Lip region continuous, 1/3 4-1/2 4 of body width at base of oesophagus. Amphids stirrup-shaped ; apertures occupying 6-7 μm or 69-75% of the corresponding body-width and 4-5 μm from anterior end. Sensillar pouches 18-20 μm from amphidial apertures.

Odontostyle 6-7 μm dorsally and 4-5 μm ventrally or 0.7-0.8 and 0.5-0.6 lip region-width long respectively, diverging at base ; aperture about 2 μm or 28-33% of the odontostyle length. Guiding ring 5-6 μm or about 0.6-0.7 lip region-width from anterior end. Odontophore curved, 13-16 μm or 2.1-2.3 times the odontostyle length. Anterior slender part of oesophagus non-muscular while basal expanded part of oesophagus muscular and separated from the former by a deep constriction. Basal expanded part of oesophagus occupying 25-29% of the oesophageal length. Oesophageal gland nuclei and their orifices not distinct

Nerve ring 75.92 μm or 43-48% of neck region. Oesophago-intestinal disc absent. Cardia rounded 6.8 μm long, enveloped by intestinal tissue. Prerectum 131.154 μm or 8.9 anal body-widths long. Rectum 21-24 μm or about one anal body-width long.

Vulva transverse. Vagina extending inward 14-15 μm or about half of the corresponding body width, with slightly sclerotized distal region. Female reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Uteri often packed with eiliptical-shaped sperm, 3-5 μm long. Oocytes arranged in a single row except the growth region.

Tail elongate-filiform, 214-253 μm or 13-15 anal body-widths long, with three caudal pores on each side.

Male : Similar to female in general morphology except the more curved ventrally posterior region and male genital system. Spicules 24-29 μm or about 1.9 1.5 anal body-width long medially. Lateral guiding pieces more or less rod-shaped, 5-7 μm long. In addition to the adanal pair, 4-5 irregularly spaced ventromedian supplements. The first ventromedian supplements situated at 2.1-2.3 anal body-widths from cloacal opening. Copulatory muscles 21-24 in number reaching up to the 4th ventromeaian supplement. Prerectum 158-203 μm or 9-10 anal body-width long (in one male prerectum 90 μm or 6 anal body widths long) starting much before supplement region. Tail similar to female, 131-2 18 μm or 8-12 anal body-widths long, with three caudal pores on each side.

Type Habitat and Locality : Soil around roots of Tea, *Thea sinensis*, from Mohargeon Tea Estate Mohargaon, Siliguri Darjeeling Road, District Darjeeling.

Types Specimens : Collected by Dr. Q. H. Baqri in December 1975 ; holotype female along with 5 paratype mounted on slide Reg. No. WN 452, Z.S.I.

Differential Diagnosis : *Dorylaimoides filicaudatus* n. sp., comes close to *D. langicaudatus* (Imamurs, 1931) Thorne and Swanger 1936 ; *D. leptura* Siddiqi, 1966 ; and *D. elaboratus*

Siddiqi, 1965 From *D. longicaudatus* it differs in having shorter body ; odontostyle ventrallay 0.6 head-width long ; and constriction at the junction of anterior slender and basal expanded part of oesophagus (L=2.67-2.98 mm ; odontostyle ventrally about 1.3 headwidth long ; anterior slender part gradually expands to form the basal expanded part of oesophagus in *D. longicaudatus*). From *D leptura* the present new species differs in having shorter body ; longer tail in female ; shorter spicules and lesser number of ventromedian supplements (L=1.96—2.34 mm ; c=11.2—15.9 ; spicules=35 μm and 8 ventromedian supplements in *D. leptura*) From *D. elaboratus* it differs in having continuous lip region ; shorter odontophore ; longer tail in females ; and the first ventromedian supplement in male situated more apart from cloacal opening lip region offset ; odontophore 18 μm ; c=8.3 ; and the first ventromedian supplement at 0.8 anal bdoy-width from cloacal opening in *D. elaboratus*).

GENUS : MORASIA Baqri and Jairajpuri, 1969

Morasia bengalensis n. sp.

(Fig -7)

Measurements :

Holotype (Female) : L=1.63 mm ; a=37 ; b=7.2 ; c=27 ; V=$\frac{10}{46}\frac{10}{}$

Paratype (Female) : L=1.53 mm ; a=34 ; b=6.8 ; c=30 ; V=$\frac{12}{46}\frac{11}{}$

Paratype (2 Male) : L=1.57—1.63 mm ; a=35—37 ; b=6.5—6.8 ; c=44—47 ; T=57-58

Description : Body curved in posterior half upon fixation and tapering slightly towards both ends. Cuticle finely striated transversely ; its thickness 2 μm at mid-body and 6-7 μm at tail. Lateral chords about $\frac{1}{7}$th—$\frac{1}{8}$th of body-width near middle. Dorsal and ventral body pores indistinct. Only a few lateral body pores can be seen in the posterior region.

Lip region offset by a slight depression ; 1/3.8—1/3.5 body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying 6-7 μm or 55—63% of the

corresponding body-width and about 4 μm from anterior end. Sensillar pouches 16-17 μm from amphidial apertures.

Odontostyle measures 8.9 μm ventrally and 11-13 μm dorsally or 1.2—1.6 and 1.1—1.2 lip region—width respectively; aperture 2 3 μm or 23—27% of its own length. Guiding ring 8 μm or about 0.7—0.8 lip region-width from anterior extremity. Odontophore typically curved, 15—17 μm long or 1.2—1.3 times the odontostyle length. Basal expanded part of oesophagus occupies 26—32% of the oesophageal length. Locations of oesophageal gland nuclei and their orifices could not be observed except the following observations made in one specimen :

DO	=	72.7	S_2N	=	92.5
DN	=	75.0	S_2O	=	93.7
DO—DN	=	2.3			

Nerve ring at 100-104 μm or 41-45% of neck region from anterior extremity. Cardia tongue-shaped, enveloped by intestinal tissue Oesophago-intestinal disc absent. Frerectum 212-224 μm or 9-10 anal body-widths long. Rectum 28-29 μm or about 1.1 anal body-width long.

Vulva a transverse slit. Vagina 21-22 μm long, extending inward about half of the corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed, oocytes arranged in a single row except at growth region. Oviduct and uterus distinctly separated by a sphincter muscle. Sperm not seen.

Tail dorsally convex conoid with rounded terminus; 51-61 μm or 2.1—2.6 anal body-widths long, with three caudal pores on each side.

Male : Similar to female in general morphology except the tail shape and the male genital system Supplements consisting of an adanal pair and 5-6 ventromedians, more or less irregularly spaced. The first ventromedian supplement located outside the spicular range. Spicules 42 μm or 1 6 anal body-width long medially. Lateral guiding pieces rod-spaped, 8-9 μm long. Prerectam measured in one specimen 148 μm or 7.7 anal body-widths long. Tail bluntly conoid, 35-36 μm or 1.3—1.4 anal body-width long, with 3-4 caudal pores on each side.

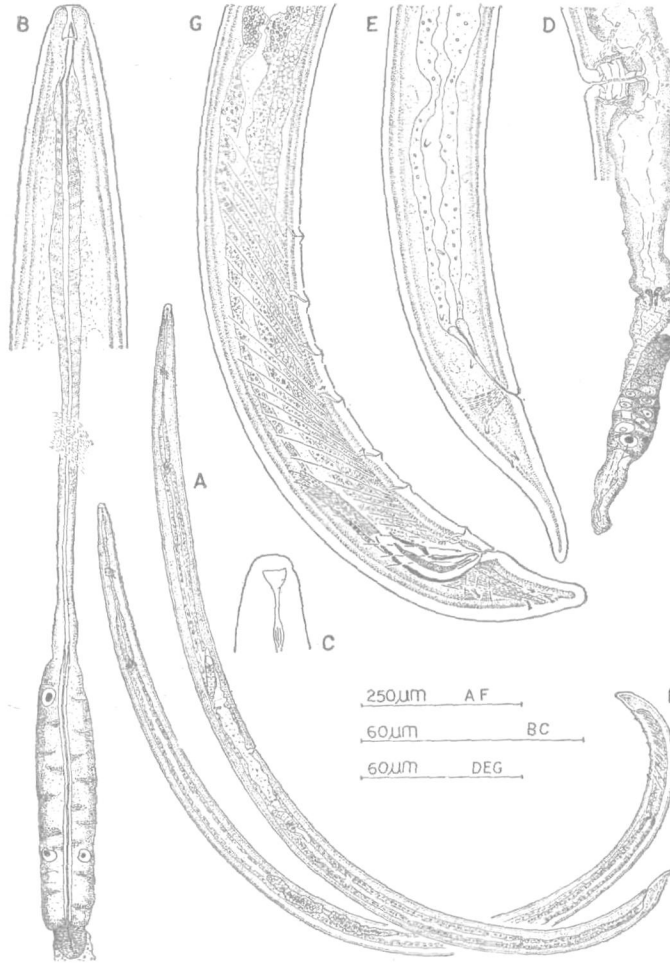

Fig. 7

Morasia bengalensis n. sp. : A. Entire female. B. Anterior end showing oesophageal region. C. Surface view of anterior end. D. Female gonads. E. Posterior region of female. F. Entire male. G. Posterior region of male.

Type habitat and Locality : Soil around roots of paddy, *Oryza sativa*, from Memari, block Memari, district Burdwan.

Type Specimens : Collected by Sri M. Ghosh Sr. Zool. Asstt. Z.S.I. in August 1977 ; holotype along with three paratypes mounted on slide Reg. No. WN 453, Z.S.I.

Differential diagnosis : *Morasia bengalensis* n. sp., comes close to *M. dimorphicauda* Baqri & Jairajpuri, 1969 but differs in the absence of glandular organs in lateral hypodermal chords (glandular organs present in *M. dimorphicauda)* and in having narrower amphidial apertures (amphidial apertures $\frac{1}{4}$th the corresponding body-width in *M. dimorphicauda*), basal expanded part of oesophagus separated by constriction (anterior slender part of oesophagus gradually swollens to form basal expanded part in *M. dimorphicauda)*, the shape of vulva and vagina, and differently shaped tails in both the sexes.

SUMMARY

The present paper reports eleven species of the superfamily Leptonchoidea (Thorne, 1935) Ferris 1971 from West Bengal, of which four are new. The brief descriptions of the following known species have been provided : *Tyleptus projectus* Thorne, 1939 ; *Dorylaimoides micoletzkyi* (de Man, 1921). Thorne & Swanger, 1936 ; *D. parvus* Thorne & Swanger, 1936 ; *D. leptura* Siddiqui, 1964; *D. arcuicaudatus* Baqri & Jairajpuri, 1969; *D. parateres* Siddiqi, 1964 *Proleptonchus clarus* Timm, 1964 has been redescribed, The following species have been found new to science : *Basirotyleptus minimus* n. sp., *Dorylaimoides subhasi* n. sp., *D. filicaudatus* n. sp., and *Morasia bengalensis* n. sp.

ACKNOWLEDGEMENT

We are thankful to The Director, Zoological Survey of India, Calcutta for providing the research facilities. The financial assistance from ICAR is also acknowledged.

NOTE :

Page No. 3, para 3, line 3 and page No. 5, para 1, line 3 read posterior uterine sac 2.0—3.2 times the corresponding body-width.

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NEMATODES FROM WEST BENGAL (INDIA) XIII. FOUR NEW SPECIES OF DORYLAIMIDAE, WITH A KEY TO THE SPECIES OF *LAIMYDORUS* SIDDIQI, 1969 (DORYLAIMOIDEA)

BY

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Four new species of the family Dorylaimidae de Man, 1876 are described here: two each belonging to *Laimydorus* Siddiqi, 1969 and *Calodorylaimus* Andrássy, 1969. *Laimydorus siddiqii* n. sp., 1.99-2.85 mm long, has a lip region marked by a depression, odontostyle 26-31 μm, odontophore 29-37 μm, female tail 12-13 anal body-widths, male with a series of 21-26 contiguous ventromedian supplements and 53-57 μm spicules. *Laimydorus baldus* n. sp., 1.83-2.44 mm long, has a lip region marked by a depression, odontostyle 24-25 μm, odontophore 29-30 μm, female tail 7-8 anal body-widths, male with a series of 24 contiguous ventromedian supplements and 53 μm spicules. *Calodorylaimus andrassyi* n. sp., 2.60-3.47 mm long, has a lip region offset by a constriction, odontostyle 25-29 μm, odontophore 25-31 μm, female tail 12-15 anal body-widths, male with 16-18 ventromedian supplements arranged in two groups and 50-59 μm spicules. *Calodorylaimus simplex* n. sp., 1.79-2.74 mm long, has a rounded lip region marked by depression, odontostule 23-27 μm, odontophore 30-34 μm, female tail 17-19 anal body-widths, male with 20-22 ventromedian supplements arranged in two groups and 43-46 μm spicules. A key to the species of *Laimydorus* is provided.

The present paper describes four new species of the family Dorylaimidae de Man, 1876: two in each of *Laimydorus* Siddiqi, 1969 and *Calodorylaimus* Andrássy, 1969. A key to the species of *Laimydorus* is provided.

The type material has been deposited in the National Collection of the Zoological Survey of India, Calcutta, India.

*Laimydorus siddiqii**) n. sp.
(Fig. 1)

Measurements

Pundibari population (Type): Paratype males (2): L = 1.99-2.25 mm; a = 34-36; b = 4.4-4.7; c = 100-125; T = 59-61.

Holotype female: L = 2.66 mm; a = 49; b = 4.6; c = 8.2; V = $^{13}48^{14}$.

Dinhata population: Female (1): L = 2.85 mm; a = 40; b = 5.1; c = 7.8; V = $^{16}45^{15}$.

Males (2): L = 2.63-2.73 mm; a = 45-46; b = 4.2-4.3; c = 91-105; T = 55-59.

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*) Named after Dr. M. R. Siddiqi, England.

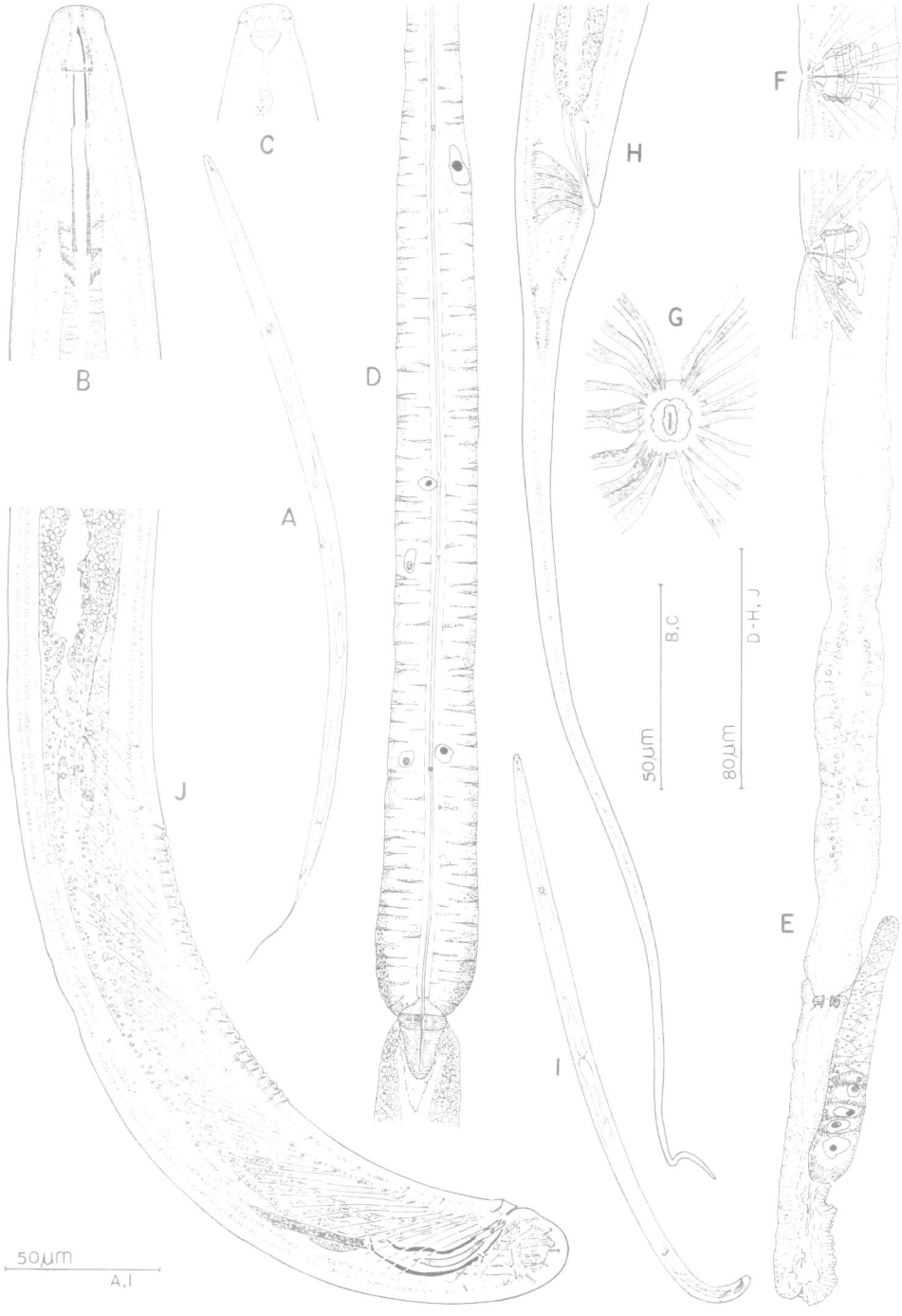

Fig. 1. *Laimydorus siddiqii* n. sp. A: Entire female; B: Anterior end of male; C: Surface view of anterior end; D: Basal expanded portion of oesophagus; E: Female reproductive system showing posterior sexual branch; F: Vulva-vagina junction; G: Vulva in mid-ventral position; H: Female tail; I: Entire male; J: Posterior region of male.

Description

Female. Body slightly ventrally curved posterior to vulva upon fixation and tapering towards both ends. Cuticle finely striated transversely; 2-4 μm thick (thickest at tail). Lateral hypodermal chords 1/4-1/3 of corresponding body-width near middle. Dorsal, ventral and lateral body pores numerous but difficult to count precisely.

Lip region marked by a depression, about 1/4 of body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying 7-9 μm or 54-60% of the corresponding body-width and 4-5 μm from anterior end. Sensillar pouches 16-18 μm from amphidial apertures.

Odontostyle 29-31 μm or 2 lip region-widths long, aperture 12-13 μm or 39-44% of the odontostyle length. Fixed guiding ring 16-19 μm or 1.1-1.2 lip region-width from anterior end. Odontophore 31-37 μm or 1.1-1.2 times the odontostyle length. Basal expanded part of oesophagus occupies 53-60% of the oesophageal length. Locations of oesophageal gland nuclei and their orifices are as follows: DO = 48.8-51.3, DN = 49.4-51.8, DO-DN = 0.4-0.6, S_1N_1 = 68.1-69.4, S_1N_2 = 72.5-74.5, S_2N = 85.0-85.6, S_2O = 86.2-86.7, K = 75.1-80.6, K′ = 75.5-81.2.

Nerve ring at 137-159 μm or 26-33% of the neck region from anterior end. Cardia tongue-shaped, 20-25 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Pre-rectum 177-208 μm or 7-8 anal body-widths long. Rectum 33-35 μm or 1.1-1.2 anal body-width long.

Vulva a longitudinal slit, 5.5 μm long (Fig. 1-G). Vagina 22-26 μm long or 36-42% of the corresponding body-width, surrounded by sphincter, with moderately sclerotized distal region. Uterus and oviduct separated by a weak sphincter. Ovary reflexed, oocytes arranged in a single row, double row and then in multiple rows at the region of growth. Sperm not seen.

Tail elongate filiform, 322-363 μm or 12-13 anal body-widths with 2-3 caudal pores on each side.

Male. Similar to female in general morphology except for the tail shape and male reproductive system. Odontostyle 26-31 μm or 2.0-2.3 lip region width long, aperture 10-13 μm or 38-42% of the odontostyle length. Odontophore 29-37 μm or 1.0-1.2 times the odontostyle. Gonads typical. Sperms spindle-shaped, 6-9 μm long. Supplements consist of an adanal pair and a series of 21-26 contiguous ventromedians. The first ventromedian supplement situated 3-4 anal body-widths from the cloacal opening. Subventral papillae 11-12, irregularly spaced, extending beyond the supplement region. Spicules 53-57 μm or 1.6-2.1 anal body-widths long when measured along the curved median line. Lateral guiding pieces 11-14 μm long. Pre-rectum 247-345 μm or 8-13 times the anal body-width. Tail bluntly rounded, 20-29 μm or 0.7-1.1 anal body-width long, with 5-7 caudal pores on each side.

Type habitat and locality. Soil around roots of paddy, *Oryza sativa* at Arabindanagar, Pundibari, district Coochbehar, West Bengal, India.

Dinhata population. Soil around roots of paddy, *Oryza sativa* at Dinhata, district Coochbehar, West Bengal.

Type specimens. Holotype female and two paratype males mounted on slide WN 458. Specimens from Dinhata on slide WN 467. Collected by the first author in November, 1975.

Differential diagnosis. Laimydorus siddiqii n. sp. comes close to *L. finalis* Thorne, 1975 and *L. thornei* Andrássy, 1969. It is shorter than *L. finalis*, with a longer tail and shorter odontostyle (L = 3.8 mm, c = 17, and odontostyle 45 μm in *L. finalis*). It has a more anteriorly situated guiding ring than *L. thornei*, and a shorter tail and longer pre-rectum (guiding ring 1.5 lip region-width, c = 4.5, and pre-rectum as long as the rectum in *L. thornei*). *L. siddiqii* also differs from both the other species in having males.

Laimydorus baldus n. sp.
(Fig. 2)

Measurements

Paratype females (3): L = 2.11-2.44 mm; a = 34-36; b = 4.8-5.1; c = 10.9-11.8; V = $^{12-14}$43-48$^{13-16}$.

Holotype female: L = 2.30 mm; a = 34; b = 4.9; c = 11.9; V = ^{15}47^{16}.

Paratype male: L = 1.83 mm; a = 35; b = 4.3; c = 77; T = 57.

Description

Female. Body almost straight upon fixation and tapering towards both ends. Cuticle finely striated transversely; 2-4 μm thick (thickest at tail). Lateral chords 1/4-1/3 of body-width near middle. Dorsal body pores 27-36, extending up to the middle of the anterior sexual branch; ventral body pores 31-48, distributed up to the middle of the posterior sexual branch. Lateral body pores irregularly spaced along both the sides of the lateral chords, 99-125 in number, of which 25-35 are in the oesophageal region and 74-90 in between the oesophago-intestinal junction and anus.

Lip region marked by a depression, 2/11-1/4 of body-width at the base of the oesophagus. Amphids stirrup-shaped; their apertures occupying about 6 μm or 46-50% of the corresponding body-width and 5-6 μm from the anterior end. Sensillar pouches 16-18 μm from the amphidial apertures.

Odontostyle 24-25 μm or 1.8-2.0 lip region-widths long; aperture occupying 10-11 μm or 42-46% of the odontostyle length. Guiding ring 14-15 μm or 1.0-1.2 lip region-width from anterior end. Odontophore 29-30 μm or 1.1-1.2 times the odontostyle length. Basal expanded part of the oesophagus occupying 46-52% of the oesophageal length. Location of oesophageal gland nuclei and their orifices are as follows: DO = 53.1-56.4, DN = 54.3-57.4, DO-DN = 1.0-1.4, S_1N_1 = 73.5-76.5, S_1N_2 = 76.5-79.6, S_2N = 86.9-88.5, S_2O = 88.2-89.5, K = 85.9-88.2, K´ = 86.7-88.8.

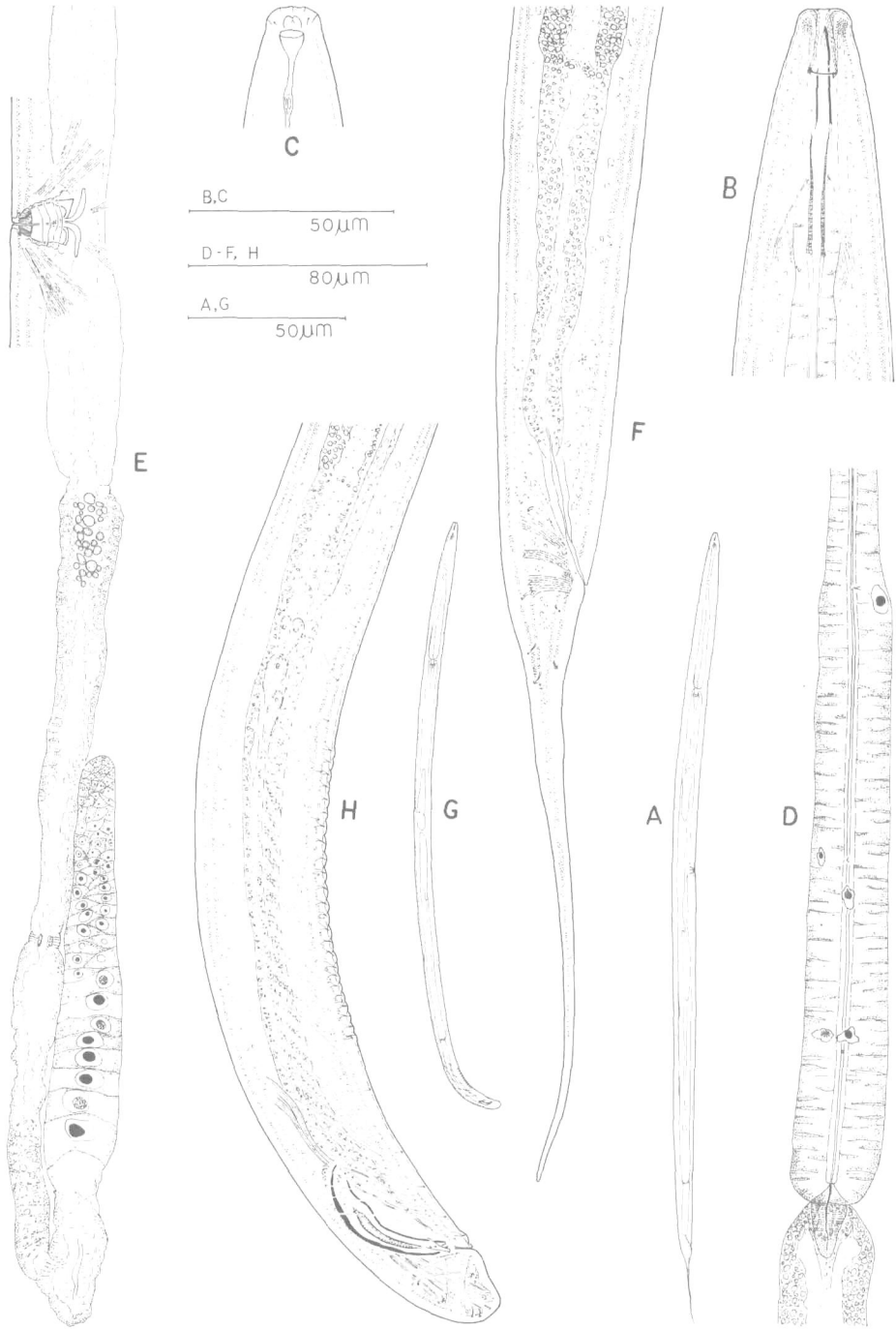

Fig. 2. *Laimydorus baldus* n. sp. A: Entire female; B: Anterior end of female; C: Surface view of anterior end; D: Basal expanded portion of oesophagus; E: Female reproductive system showing posterior sexual branch; F: Female tail; G: Entire male; H: Posterior region of male.

Nerve ring 137-147 μm or 30-33% of the neck region from anterior end. Cardia 18-20 μm, elongate with rounded terminus, enveloped by intestinal tissue. Oesophago-intestinal disc absent. Pre-rectum 122-157 μm or 4.6-5.4 anal body-widths long. Rectum 40-45 μm or 1.5-1.6 anal body-widths long.

Vulva a transverse slit. Vagina 22-24 μm or extending inward 35-40% of the corresponding body-width, surrounded by sphincter, with sclerotized distal region. Female reproductive system amphidelphic. 'Z' pseudo-organs observed in the middle of the uteri. Uterus and oviduct separated by sphincter, ovary reflexed; oocytes arranged first in a single row, then in a double row and in multiple rows at growth region.

Tail elongate filiform, 190-224 μm or 7-8 anal body-widths long, with 4-5 caudal pores on each side.

Male. Similar to female in general shape and morphology except for the tail shape and male reproductive system. Odontostyle 24 μm or 2 times the lip region-width, aperture 10 μm or 42% of the odontostyle length. Odontophore 29 μm or 1.2 odontostyle lengths. Gonads typical. Sperms spindle-shaped 7-9 μm long. Supplements consist of an adanal pair and a series of 24 contiguous ventromedians. First ventromedian supplement situated 3 anal body-widths from cloacal opening. Spicules 53 μm or 1.8 anal body-widths long medially. Lateral guiding pieces rod-shaped, 9 μm long. Pre-rectum 236 μm or 8.4 anal body-width long. Tail bluntly rounded, 22 μm or 0.8 anal body-width long, with 5-6 caudal pores on each side.

Type habitat and locality. Soil around roots of paddy, *Oryza sativa* at Chakchaka, district Coochbehar, West Bengal, India.

Type specimens. Holotype and 4 paratypes mounted on slide WN 459. Collected by the first author in November, 1975.

Differential diagnosis. Laimydorus baldus n. sp. resembles *L. gazella* Andrássy, 1970 and *L. stenopygus* (Andrássy, 1968) Siddiqi, 1969. It differs from *L. gazella* in having amalgamated lips, lip region marked by a slight depression and narrower than adjoining body, shorter odontostyle, and the male with 53 μm long spicules (lips distinct, lip region marked by a constriction and wider than adjoining body, odontostyle 28-29 μm, and male with 58 μm long spicules in *L. gazella*): it differs from *L. stenopygus* in having amalgamated lips, lip region marked by a depression and narrower than adjoining body, differently shaped amphids, and a shorter oesophagus (lips distinct, lip region marked by a constriction and wider than adjoining body, and b = 4.0-4.3 in *L. stenopygus*).

KEY TO SPECIES OF *LAIMYDORUS* SIDDIQI, 1969 BASED UPON FEMALES
(Wherever c-values are given, they are of females only)

1. Odontostyle more than two head-widths long 2
   Odontostyle less than two head-widths long 11
2. Odontostyle about 3 head-widths long ..... *crassoides* (Jägerskiöld, 1908) Siddiqi, 1969
   Odontostyle less than 2.5 head-widths long 3
3. V = 38-41 4
   V = >43 6

4. Lip region continuous with body, tail longer (c = 5.9) ..... *serpentinus* (Thorne & Swanger, 1936) Siddiqi, 1969
Lip region wider than adjoining body and marked by constriction, tail shorter (c = >8.6) 5
5. Odontostyle > 55 μm long, male with 140 μm long spicules ..... *unipapillatus* (Daday, 1905) Andrássy, 1969
Odontostyle 52-53 μm long, male with 100-105 μm spicules ..... *parhomalopapillatus* (S. Stekhoven, 1944) Baqri & Coomans, 1973
6. Cuticle about twice the odontostyle width in its corresponding region ..... *callosus* (Skwarra, 1921) Andrássy, 1969
Cuticle as thick as or thinner than the odontostyle width in its corresponding region 7
7. Lip region well offset by a constriction, lips elevated due to papillae ..... *pseudostagnalis* (Micoletzky, 1927) Siddiqi, 1969
Lip region marked by a depression or continuous, lips not elevated 8
8. Ovary abnormally long, sometimes extending into the oesophageal region ..... *prolificus* (Thorne & Swanger, 1936) Siddiqi, 1969
Ovary normal in length 9
9. Lip region continuous with body, tail longer (c = 4.5) ..... *thornei* Andrássy, 1969
Lip region marked by a depression, tail shorter (c = 7.8) 10
10. Odontostyle 45 μm long ..... *finalis* Thorne, 1975
Odontostyle 26-31 μm long ..... *siddiqii* n. sp.
11. Odontostyle more than 1.5 head-widths long 12
Odontostyle less than 1.3 head-widths long 24
12. Lip region continuous with body 13
Lip region markedly offset by a constriction or depression 17
13. Four submedian elongate yellow gland-like bodies present near the base of odontostyle ..... *flavomaculatus* (Linstow, 1876) Siddiqi, 1969
Yellow gland-like bodies absent 14
14. Tail shorter (c = 21-29) ..... *luettichaui* (Meyl, 1957) Siddiqi, 1969
Tail longer (c = 5-16) 15
15. Odontostyle 1.7 head-widths long, b = 4.3 ..... *conurus* (Thorne, 1939) Siddiqi, 1969
Odontostyle 1.5 head-widths long; b = 5.4-6.0 16
16. L = 1.8 mm, vulva transverse ..... *incae* (Steiner, 1920) Thorne, 1974
L = 2.3 mm, vulva longitudinal ..... *paraincae* Thorne, 1974
17. Amphids oval, twice as long as wide; V = 39 ..... *marinus* (Dujardin, 1845) Siddiqi, 1969
Amphids stirrup-shaped, about as long as wide, V = 42-49 18
18. Guiding ring one head-width or less from anterior end 19
Guiding ring more than one head-width from anterior end 21
19. Tail 13 anal body-widths long (c = 5.4-5.5) ..... *vixamictus* (Andrássy, 1962) Siddiqi, 1969
Tail less than 8 anal body-widths long (c = > 7) 20
20. L = 1.9-2.3 mm; b = 4.3-5.1; c = 10-14 ..... *parabastiani* (Paetzold, 1958) Siddiqi, 1969
L = 1.65-1.75 mm; b = 5.3-5.8; c = 7-8 ..... *dadayi* (Thorne & Swanger, 1936) Andrássy, 1969
21. Tail longer (c = 5.0) ..... *acris* (Thorne, 1939) Siddiqi, 1969
Tail shorter (c = > 11) 22
22. Odontostyle 1.6-1.8 head-widths long; b = 4.0-4.3; male with 48-50 μm long spicules ..... *stenopygus* (Andrássy, 1968) Siddiqi, 1969
Odontostyle 1.8-2.0 head-widths long; b = 4.7-5.1; male with 53-58 μm long spicules ... 23
23. Lips amalgated, narrower than adjoining body; male with 53 μm long spicules ..... *baldus* n. sp.
Lips distinct, wider than adjoining body, male with 58 μm long spicules ..... *gazella* Andrássy, 1970
24. Tail short elongate conoid (c = 15-28) 25
Tail attenuated filiform (c = 5-12) 26
25. Lip region collar-like; b = 3.6 ..... *halophilus* (Daday, 1897) Andrássy, 1969
Lip region not collar-like; b = 5.0 ..... *reversus* Thorne, 1974

26. L = 1.2-1.6 mm; lip region continuous with body ..... *hofmanneri* (Menzel in Hofmanner & Menzel, 1914) Andrássy, 1969
L = > 1.8 mm; lip region either marked by depression or constriction 27
27. Cuticle 1.5 times the odontostyle width in its corresponding region ..... *proximus* (Thorne & Swanger, 1936) Siddiqi, 1969
Cuticle as thick as odontostyle width in its corresponding region 28
28. Lip region off-set by a deep constriction, lips angular; c = 10-12 ..... *cryptosperma* (Loof, 1969) Baqri & Coomans, 1973
Lip region off-set by a slight constriction, lips not angular; c = 7.1-7.2 ..... *tenuicaudatus* (Bastian, 1865) Siddiqi, 1969

Species inquirenda

Laimydorus longissimicaudatus Alther, 1977: The systematic position of this species remains uncertain because of poor description and illustration, and the absence of males.

Species not included in key

L. filiformis (Bastian, 1865): Andrássy (1969) transferred this species to the genus *Paradorylaimus* Andrássy, 1969.

L. crassus (de Man, 1884): Loof states that this species is a true *Dorylaimus* species.

L. agilis (de Man, 1886): Loof (1969) transferred it to *Eudorylaimus* Andrássy, 1959.

L. saprophilus (Peters, 1930): Andrássy (1969) considered it a synonym of *Dorylaimus stagnalis*.

L. flexus (Thorne & Swanger, 1936): Andrássy (1969) transferred it to *Drepanodorylaimus* Jairajpuri, 1966.

L. effilatus (S. Stekhoven & Teunissen, 1938): Baqri & Coomans (1973) transferred it to *Mesodorylaimus* Andrássy, 1959.

*Calodorylaimus andrassyi** n. sp.
(Fig. 3)

Measurements

Navagram population (Type). Paratype females (2): L = 2.93-3.47 mm; a = 60-64; b = 5.6-6.1; c = 8.0-11.1; V = $^{12}44^{13-14}$.

Holotype female: L = 3.06 mm; a = 65; b = 5.4; c = 8.7; V = $^{12}46^{12}$.

Paratype males (3): L = 2.60-2.74 mm; a = 60-61; b = 4.8-5.1; c = 131-153; T = 57-65.

Basantabati population. Female (1): L = 2.94 mm; a = 61; b = 5.6; c = 9.2; V = $^{12}45^{13}$.

Male (1): L = 3.12 mm; a = 58; b = 5.6; c = 260; T = 63.

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*) Named after Dr. I. Andrássy, Hungary.

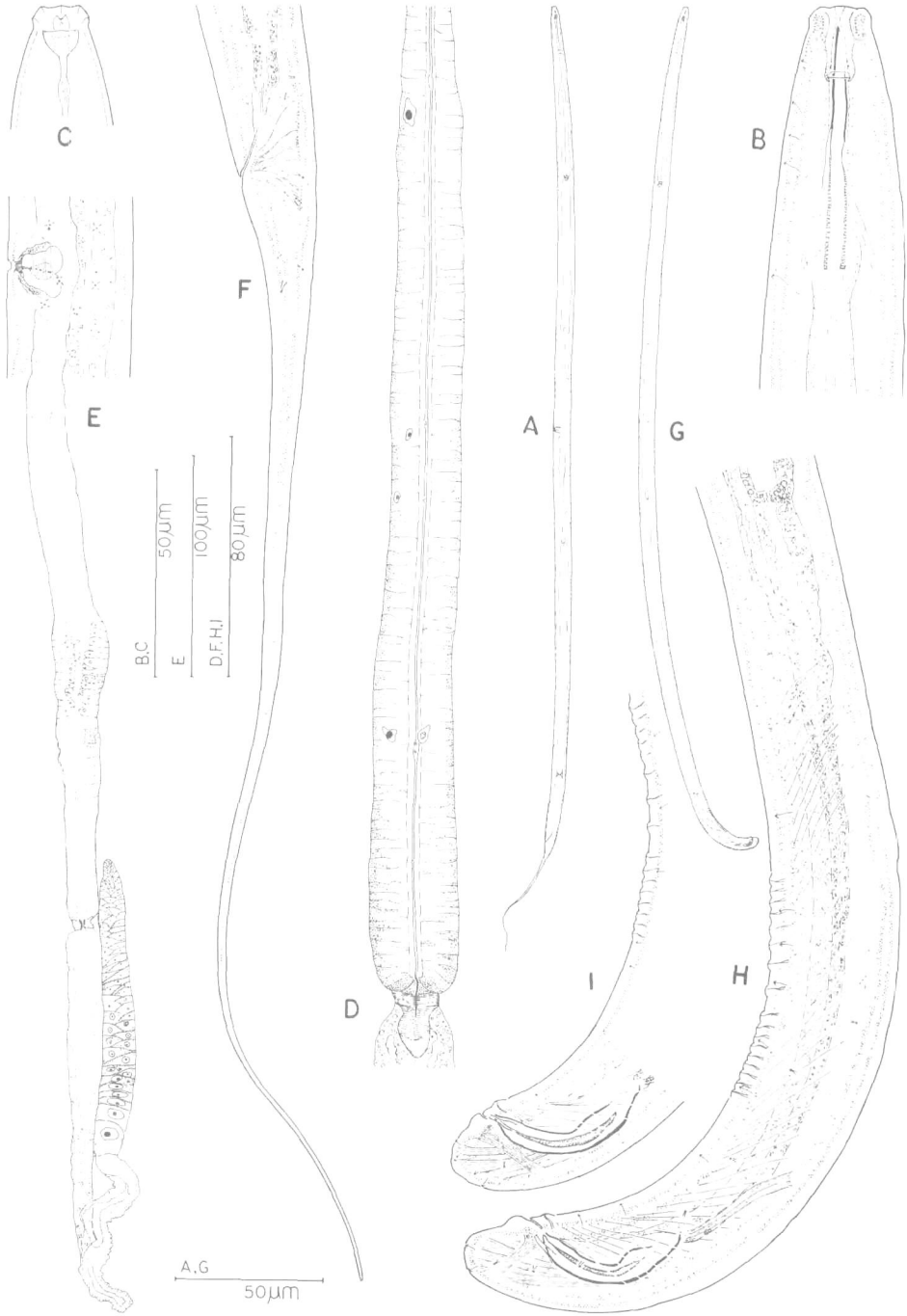

Fig. 3. *Calodorylaimus andrassyi* n. sp. A: Entire female; B: Anterior end of female; C: Surface view of anterior end; D: Basal expanded portion of oesophagus; E: Female reproductive system showing posterior sexual branch; F: Female tail; G: Entire male; H: Posterior region of male; I: Posterior region of male showing variation in tail shape.

Description

Female. Body almost straight upon fixation except in the tail region, tapering towards both ends. Cuticle loose, finely striated transversely; 2-4 μm thick (thickest on tail). Lateral chords 1/3-2/5 of body-width near middle. Dorsal and ventral body pores 9-13 and 16-17 respectively, restricted to the oesophageal region. Lateral body pores 85-107, distributed irregularly along both sides of the lateral chords, with 18-22 in the oesophageal region and 67-85 between oesophago-intestinal junction and anus.

Lip region off-set by a constriction, slightly wider than adjoining body, about 1/3 of body-width at base of oesophagus. Amphids stirrup-shaped, divided in four chambers by faint partitioned lines, apertures occupying 8-9 μm or 59-64% of the corresponding body-width and 5-6 μm from anterior end. Sensillar pouches 14-16 μm from amphidial apertures.

Odontostyle measures 26-29 μm or $1^1/_2$ to 2 lip region-widths long; aperture 12-13 μm or 44-48% of the odontostyle length. Guiding ring 14-16 μm or about one lip region-width from anterior end. Odontophore 27-31 μm or 1.0-1.1 times the odontostyle length. Locations of oesophageal gland nuclei and their orifices are as follows: DO = 46.5-49.9; DN = 47.3-51.6; DO-DN = 0.8-1.7; S_1N_1 = 66.1-68.8; S_1N_2 = 71.3-73.5; S_2N = 83.8-85.4; S_2O = 84.8-86.6; K = 78.0-82.7; K′ = 78.7-83.5.

Nerve ring at 131-147 μm or 25-27% of the neck region. Cardia tongue-shaped, 15-17 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Pre-rectum 204-255 μm or 8-10 times the anal body-width. Rectum 33-37 μm or about 1.3 anal body-widths long.

Vulva transverse. Vagina 23-25 μm or extending inward 43-47% of the corresponding body-width, surrounded by sphincter. Female reproductive system amphidelphic. Uterus and oviduct separated by weak sphincter. Ovary reflexed; oocytes arranged in a single row, double row and multiple rows at growth region.

Tail elongate filiform, 312-367 μm or 12-15 anal body-widths long, with 3-4 caudal pores on each side.

Male. Similar to female in general shape and morphology, except in the curved posterior region, tail shape and male reproductive system. Odontostyle 25-27 μm or 1.7-2.0 lip region-widths long, aperture 12-13 μm or 46-48% of the odontostyle length. Odontophore 25-30 μm or 0.9-1.2 odontostyle length. Gonads typical. Sperms elliptical, 7-11 μm long. Supplements consist of an adanal pair and 16-18 ventromedians, the latter arranged in two groups as illustrated (Fig. 3, I & H). The first ventromedian supplement situated about 3 anal body-widths from cloacal opening. Subventral papillae 8-10, irregularly spaced. Spicules measure 50-59 μm along the curved median line or $1^3/_4$ to 2 anal body-widths long. Lateral guiding pieces 11-14 μm long. Pre-rectum 257-302 μm or 9-11 anal body-widths long. Tail varies from bluntly rounded to

slightly bluntly conoid, 18-23 μm or less than one anal body-width long, with 4-5 caudal pores on each side.

Type habitat and locality. Soil around roots of paddy, *Oryza sativa* at Navagram, district Burdwan, West Bengal, India.

Basantabati population. Soil around roots of paddy, *Oryza sativa* at Basantabati, district Burdwan.

Type specimens. Holotype and 5 paratypes mounted on slide WN 460. Specimens from Basantabati on slide WN 468. Collected by the first author in December, 1977.

Differential diagnosis. Calodorylaimus andrassyi n. sp. differs from *C. octo* Andrássy, 1969 in having posteriorly situated vulva, shorter tail in female, shorter odontostyle and odontophore, and longer spicules in male (V = 36-37; tail 20-27 anal body-width long, odontostyle = 32-35 μm, odontophore = 42-47 μm, and spicules 57-60 μm in *C. octo*).

Calodorylaimus simplex n. sp.
(Fig. 4)

Measurements

Balut population (Type). Paratype female: L = 2.30 mm; a = 47; b = 5.4; c = 6.1; V = $^{15}45^{15}$.

Holotype female: L = 2.39 mm; a = 44; b = 5.3; c = 6.0; V = $^{16}44^{17}$.

Paratype males (2): L = 1.79-1.93 mm; a = 37-40; b = 4.2-4.6; c = 112-121; T = 51-53.

Majherpara population. Females (2): L = 2.57-2.74 mm; a = 46-51; b = 5.3-5.4; c = 6.7-6.8; V = $^{16-18}45^{16-17}$.

Male (1): L = 2.17 mm; a = 44; b = 4.5; c = 128; T = 60.

Description

Female. Body slightly curved ventrally on fixation, tapering towards both extremities. Cuticle finely striated transversely, 1.5-3.0 μm thick (thickest at tail). Lateral chords 1/4-1/3 of the body-width near middle. Dorsal and ventral body pores indistinct. Lateral body pores distinct only in posterior third of body.

Lip region rounded, amalgamated, marked by a depression, about 1/4 of the body-width at base of oesophagus. Amphids stirrup-shaped, divided in two parts by a faint line; their apertures occupying 7-8 μm or 58-64% of the corresponding body-width and 5-6 μm from anterior end. Sensillar pouches 16-18 μm from amphidial apertures.

Odontostyle 23-27 μm or about two times the lip region-width; aperture 10-11 μm or 38-42% of the odontostyle length. Guiding ring at 14-16 μm or 1-1½ lip region-widths from anterior end. Odontophore 30-34 μm or 1.2-1.4 times the odontostyle length. Basal expanded part of oesophagus occupies 52-60% of the neck region. Locations of oesophageal gland nuclei and their

Fig. 4. *Calodorylaimus simplex* n. sp. A: Entire female; B: Entire male; C: Anterior end of female; D: Surface view of anterior end; E: Basal expanded portion of oesophagus; F: Female reproductive system showing posterior sexual branch; G: Female tail; H: Posterior region of male; I: Variation in the tail shape of male.

orifices are as follows: DO = 52.5-54.3; DN = 53.3-56.8; DO-DN = 0.6-2.5; S_1N_1 = 70.8-72.5; S_1N_2 = 75.1-75.7; S_2N = 85.3-85.9; S_2O = 86.4-86.8; K = 78.3-86.6; K′ = 79.1-87.3.

Nerve ring at 133-139 μm or about 28% of the neck region from anterior end. Cardia 16-19 μm long, tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Pre-rectum 141-180 μm or 6-8 anal body-widths long. Rectum 37-41 μm or $1^1/_2$-$1^3/_4$ anal body-widths long.

Vulva a transverse slit, situated in a depression. Vagina 24-27 μm or extending inward 46-50% of the corresponding body-width, surrounded by sphincter, with sclerotized distal region. Female reproductive system amphidelphic. Oviduct and uterus separated by sphincter. Sperms present in uteri, 4-9 μm long, oval to elliptical in shape. Ovary reflexed; oocytes arranged in a single row, double row and then in multiple row at growth region.

Tail long filiform, whip-like, 357-406 μm or 17-19 anal body-widths long, with two caudal pores on each side.

Male. Similar to female in general shape and morphology except in the tail shape and male reproductive system. Odontostyle 24-27 μm or about 2 times the lip region-width, aperture 10-11 μm or 40-42% of the odontostyle length. Odontophore 30-32 μm or about 1.2 odontostyle lengths. Gonads typical. Supplements consist of an adanal pair and 20-22 ventromedians, the latter arranged in two groups as illustrated (Fig. 4, H). The first supplement situated at about 2 anal body-widths from cloacal opening. Subventral papillae 9-13, irregularly spaced. Spicules 43-46 μm or $1^3/_4$-2 anal body-widths long medially. Lateral guiding pieces 8-9 μm long. Pre-rectum 226-357 μm or 9-16 anal body-widths long. Tail bluntly rounded, 17-19 μm or 2/3-4/5 of the anal body-width long. Caudal pores not visible.

Type habitat and locality. Soil around roots of paddy, *Oryza sativa* at Balut, district Burdwan, West Bengal, India.

Majherpara population. Soil around roots of paddy, *Oryza sativa* at Majherpara, district Burdwan.

Type specimens. Holotype and 3 paratypes mounted on slide WN 461. Specimens from Majherpara on slide WN 469.

Differential diagnosis. Calodorylaimus simplex n. sp. comes close to *C. andrassyi* n. sp. but differs in having more slender body and longer tail, differently shaped lip region, the male with more ventromedian supplements, and shorter spicules and lateral guiding pieces (a = 58-65; c = 8.0-11.1, lip region constricted and wider than adjoining body with distinct lips, male with 16-18 ventromedian supplements, spicules 50-54 μm long and lateral guiding pieces 11-14 μm long in *C. andrassyi* s. sp.).

The authors thank Dr. B. K. Tikadar, Director, Zoological Survey of India, Calcutta for providing research facilities. Financial assistance from I.C.A.R., New Delhi is also acknowledged for conducting the survey under the All India

Co-ordinated Research Project on Nematode Pests of Crops and Their Control.

RÉSUMÉ

Nématodes du Bengale de l'Ouest (Inde). XIII. Quatre nouvelles espèces de Dorylaimidae et clé des espèces de Laimydorus *Siddiqi, 1969 (Dorylaimidae).*

Quatre nouvelles espèces de Dorylaimidae de Man, 1876 sont décrites dont deux appartenant au genre *Laimydorus* Siddiqi, 1969 et deux au genre *Calodorylaimus* Andrássy, 1969. Ces nouvelles espèces ont les caractéristiques suivantes: *Laimydorus siddiqii* n. sp.: L = 1,99-2,85 mm; région labiale marquée par une dépression; odontostyle = 26-31 μm; odontophore = 29-37 μm; c′ (femelles) = 12-13; 21-26 suppléments ventromédians; spicules = 53-57 μm. *Laimydorus baldus* n. sp.: L = 1,83-2,44 mm; région labiale marquée par une dépression; odontostyle = 24-25 μm; odontophore = 29-30 μm; c′ (femelles) = 7-8; 24 suppléments ventromédians contigus; spicules = 53 μm. *Calodorylaimus andrassyi* n. sp.: L = 2,60-3,47 mm; région labiale séparée du reste du corps par une constriction; odontostyle = 25-29 μm; odontophore = 25-31 μm; c′ (femelles) = 12-15; 16-18 suppléments ventromédians disposés en deux groupes; spicules = 50-59 μm. *Calodorylaimus simplex* n. sp.: L = 1,79-2,74 mm; région labiale arrondie, séparée du reste du corps par une dépression; odontostyle = 23-27 μm; odontophore = 30-34 μm; c′ (femelles) = 17-19; 20-22 suppléments ventromédians disposés en deux groupes; spicules = 43-46 μm. Une clé des espèces du genre *Laimydorus* est proposée.

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DESCRIPTION OF THE MALE AND NOTES ON THE FEMALE OF *HELICOTYLENCHUS DIGONICUS* PERRY IN PERRY, DARLING & THORNE, 1959 (NEMATODA: TYLENCHIDA) FROM JORDAN

BY

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The spiral nematode, *Helicotylenchus digonicus* Perry in Perry, Darling & Thorne, 1959, of which only the females have been described, is widely distributed. A single male of this species was recovered from the rhizosphere of olive (*Olea europaea* L.) in Wadi Seer, Jordan, and is described here for the first time together with notes on the female. Specimens were killed by heat, fixed in TAF (formalin-triethanolamine mixture), immersed in hot (60°C) lactophenol with cotton blue stain, processed to glycerol by a rapid method (Baker, 1953) and then mounted in glycerol containing traces of picric acid.

Description of the male (Fig. 1, A-E)

Measurements: Male (n = 1): L = 0.76 mm; a = 38; b = 5.4; b´ = 4.5; c = 38; c´ = 1.6; T = 30; stylet = 25 μm; m = 50; 0 = 40; MB = 53; spicule = 29 μm; gubernaculum = 7.2 μm.

Description: Male: Body ventrally arcuate when killed by heat (Fig. 1, D). Cephalic (labial) region anteriorly flattened with rounded sides, continuous with the body, about 4 μm high and with five annules (Fig. 1, A). Cephalic framework moderately sclerotized, with crescent-shaped outer margins extending posteriorly for almost three body annules. Vestibule extension about 7.5 μm in length. Stylet knobs posteriorly rounded, with indented anterior surfaces. Anterior cephalids indistinct, located within the fourth (on one side) and fifth (the other side) body annules; posterior cephalids not seen. Orifice of dorsal oesophageal gland located 10 μm behind stylet base. Median oesophageal bulb oval, 18.5 × 13 μm, with prominent valvular apparatus. Oesophageal glands overlapping the intestine, with the longest overlap ventrally situated, 29 μm in length and extending about 19 annules (Fig. 1, B). Dorsal gland nucleus distinct; other gland nuclei difficult to discern. Excretory pore located eight annules anterior to the oesophago-intestinal junction, two annules behind the hemizonid and at 130 μm from the anterior end. Hemizonid not prominent, occupying about three body annules. Hemizonion located within the ninth annule behind the excretory pore.

Indian J. Nematol. **12**(2), 1982 : 263-271

NEMATODES FROM WEST BENGAL (INDIA XII). *DORYLAIMUS INNOVATUS* SP. N., *THONUS CONFUSUS* SP. N. AND *INDOKOCHINEMA EKRAMULLAHI* SP. N. (DORYLAIMOIDEA)

BY

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Dorylaimus innovatus sp. n. has L=4.2 mm, cuticle marked with 34-36 longitudinal lines on the surface, lip region marked by a depression, odontostyle 47-52 μm long; male with 110 μm long spicules and a series of 44 contiguous ventromedian supplements. *Thonus confusus* sp. n. has L=1.1-1.3 mm; lip region offset by a slight constriction, odontostyle 11-12 μm long with 41-42% aperture, female with rounded tail; male with 47-52 μm long spicules, 14-16 contiguous ventromedian supplements and bluntly rounded tail. *Indokochinema ekramullahi* sp. n. has L=1.1-1.3 mm, lip region offset by a constriction and wider than adjoining body, amphids stirrup-shaped in labial region, and dorsally convex-conoid tail with rounded terminus.

DORYLAIMUS INNOVATUS SP. N.
(Fig. 1)

Measurements :

1 ♂ (*Paratype*) : L=4.23 mm; a=42; b=4.9; c=125;

Female (*Holotype*) : L=4.29 mm; a=38; b=4.8; c=14; V=$^{144}31^{5}$.

Description :

Female : Body ventrally curved upon fixation, tapering gradually towards both ends. Cuticle finely triated transversely, marked with 34-36 longitudinal lines on the surface, its thickness 8-10 μm at mid-body and 10-11 μm at tail. Lateral chords 1/3.7-1/3.4 of body-width near middle. Dorsal body pores 7; ventral body pores 37, of which 18 are in between anterior end and vulva region and 19 are from vulva to anal region. Lateral body pores 113, distributed along both sides of lateral chords, of which 27 are in the oesophageal region, 83 in between oesophagus and anus and 3 in caudal region.

Lip region marked by a slight depression 1/5.6-1/4.5 of body-width at base of oesophagus. Lips amalgamated. Amphids stirrup-shaped, apertures

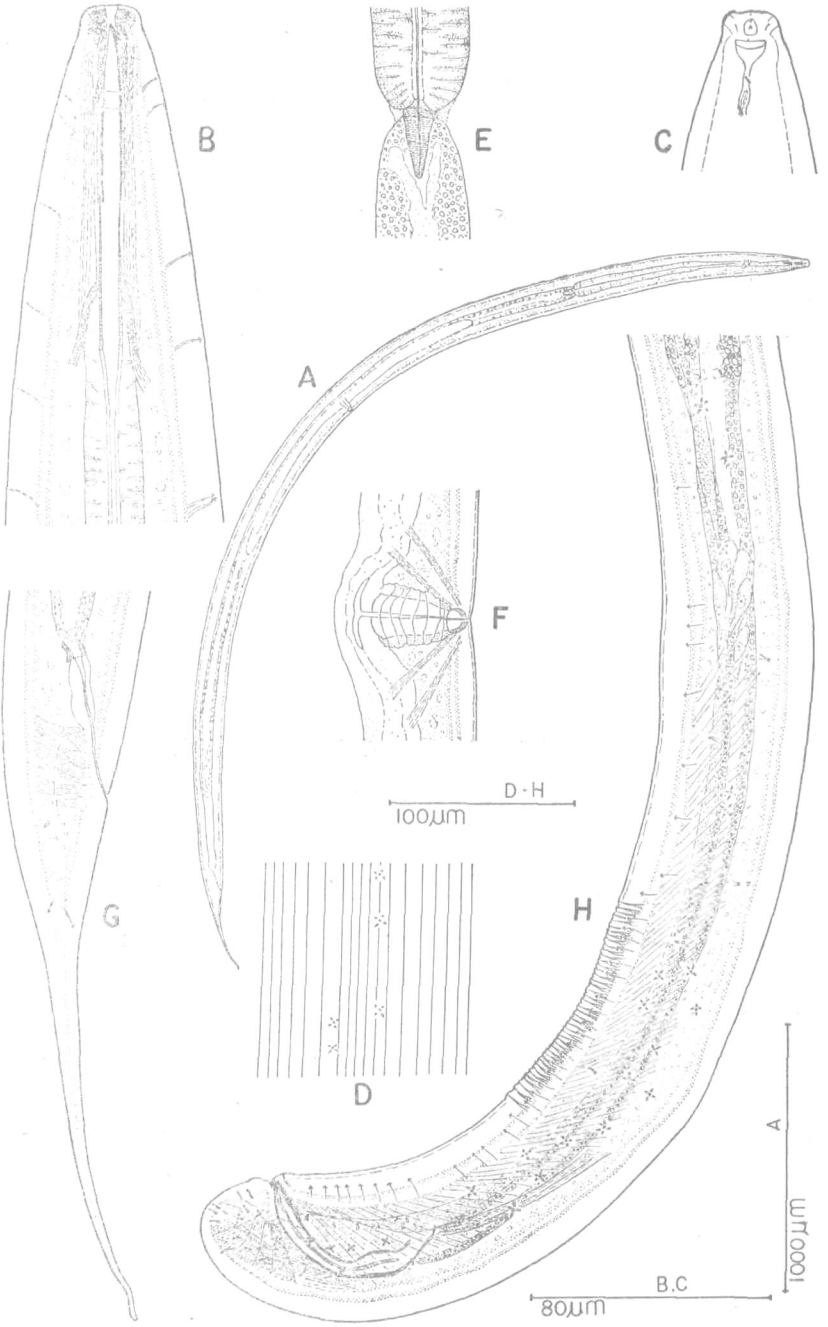

Fig. 1, A-H. *Dorylaimus innovatus* sp. n. A—Entire female; B—Anterior end of female; C—Surface view of anterior end; D—Longitudinal lines in the cuticle; E—Oesophago-intestinal junction; F—Vulva-vagina region; G—Posterior region of female; H—Posterior region of male.

occupying 9-10 μm or 46-50% of the corresponding body-width. Sensillar pouches 16-17 μm from amphidial apertures.

Odontostyle 47-52 μm or 2.2-2.7 lip region-width long, 6-7 μm thick; aperture 42-46% of its own length. Guiding ring at 25-30 μm or 1.1-1.5 head-width from anterior end. Odontophore 47-52 μm or 0.9-1.1 times the odontostyle length. The basal expanded part of oesophagus occupying 56-63% of the neck region. Locations of oesophageal gland nuclei and their orifices are not distinct.

Nerve ring at 214-229 μm or 25-26% of neck region from anterior end. Cardia 34-36 μm, elongate conoid, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 290 μm or about 5 anal body-width long. Rectum 82 μm or 1 4 anal body-width long.

Vulva a transverse slit. Vagina extending inward 63 μm or 56% of the corresponding body-width, with moderately sclerotized distal region. Female reproductive system amphidelphic. Uterus, oviduct and oocytes are not clearly visible.

Tail elongate-conoid with subacute terminus, 308 μm or 5.4 anal body-width long, with three caudal pores on each side.

Male : Similar to female in general morphology except the dissimilar tail shape and male genital system. Spicules 110 μm or 1.8 anal body-width long medially. Lateral guiding pieces rod-shaped, 20 μm long. In addition to an adanal pair, a series of 44 contiguous ventromedian supplements present. Subventral paillae 39, spaced irregularly, up to prerectum-intestine junction. Copulatory muscles in large number, extending above the supplement region, Prerectum 520 μm or 8.5 anal body-width long.

Tail short bluntly rounded, 34 μm or 0.5 anal body-width long, with 10 caudal pores on each side.

Type habitat and locality : Soil around roots of paddy, *Oryza sativa* L., at Rasulpur, district Burdwan, W. Bengal.

Type specimens : Holotype female mounted on slide No. WN 456 and paratype male on slide WN 457.

Differential diagnosis : *Dorylaimus innovatus* sp. n. comes close to *D. stagnalis* Dujardin, 1845 but differs in having differently shaped lip region, amphidial pouch, and longer spicules and subventral papillae extending up to intestine-prerectum junction in male (lips prominent, spicules 100 μm and subventral paillae restricted up to ventromedian supplement region in *D. stagnalis*).

THONUS CONFUSUS SP.N.
(Fig. 2)

Measurements :

3 ♀♀ (*Paratypes*) : L=1.28-1.35 mm; a=27-29; b=4.1-4.5; c=47-52; V=$^{14-17}52$-55^{14-16}.

Female (*Holotype*) : L=1.17 mm; a=26; b=4.1; c=54; V=$^{17}56^{16}$.

5 ♂♂ (*Paratypes*) : L=1.12-1.41 mm; a=25-30; b=3.8-4.6; c=51-64; T=50-53.

Description :

Female : Body slightly curved ventrally upon fixation and tapering gradually towards both extremities. Cuticle finely striated transversely; its thickness 2 μm at mid-body and 6-8 μm at tail. Lateral chords granular, 1/3.5-1/2.8 of body-width near middle. Dorsal, Ventral and lateral body pores indistinct.

Lip region offset by a slight constriction, wider than adjoining body, about $^1/_4$th of the body-width at base of oesophagus. Amphids stirrup-shapped, their apertures occupying 5-6 μm or 46-50% of the corresponding body-width and 4-5 μm from anterior end. Sensillar pouches 15-16 μm from amphidial apertures.

Odontostyle measures 11-12 μm or 1.0-1.1 lip region-width long; aperture 5 μm or about 41-42% of odontostyle length. Guiding ring 7-8 μm or 0.6-0.7 lip region-width from anterior end. Odontophore 16-18 μm or 1.3-1.5 times the odontostyle length. Basal expanded part of oesophagus occupying 43-47% of the neck region. Locations of oesophageal gland nuclei and their orifices as follows :

DO=59.1-60.5	S_1N_1=74.7-77.6	S_2N=88.5-89.4
DN=61.1-62.6	S_1N_2=78.2-80.1	S_2O=89.5-90.9
DO-DN= 1.3-2.5		
K=78.5-88.1	K′=81.2-89.5	

Nerve ring at 99-108 μm or 32-35% of the neck region from anterior end. Cardia tongue-shaped, 11-13 μm, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 71-86 μm or 2.2-2.6 anal body-width long. Rectum 35-37 μm or 1.1-1.3 anal body-width long.

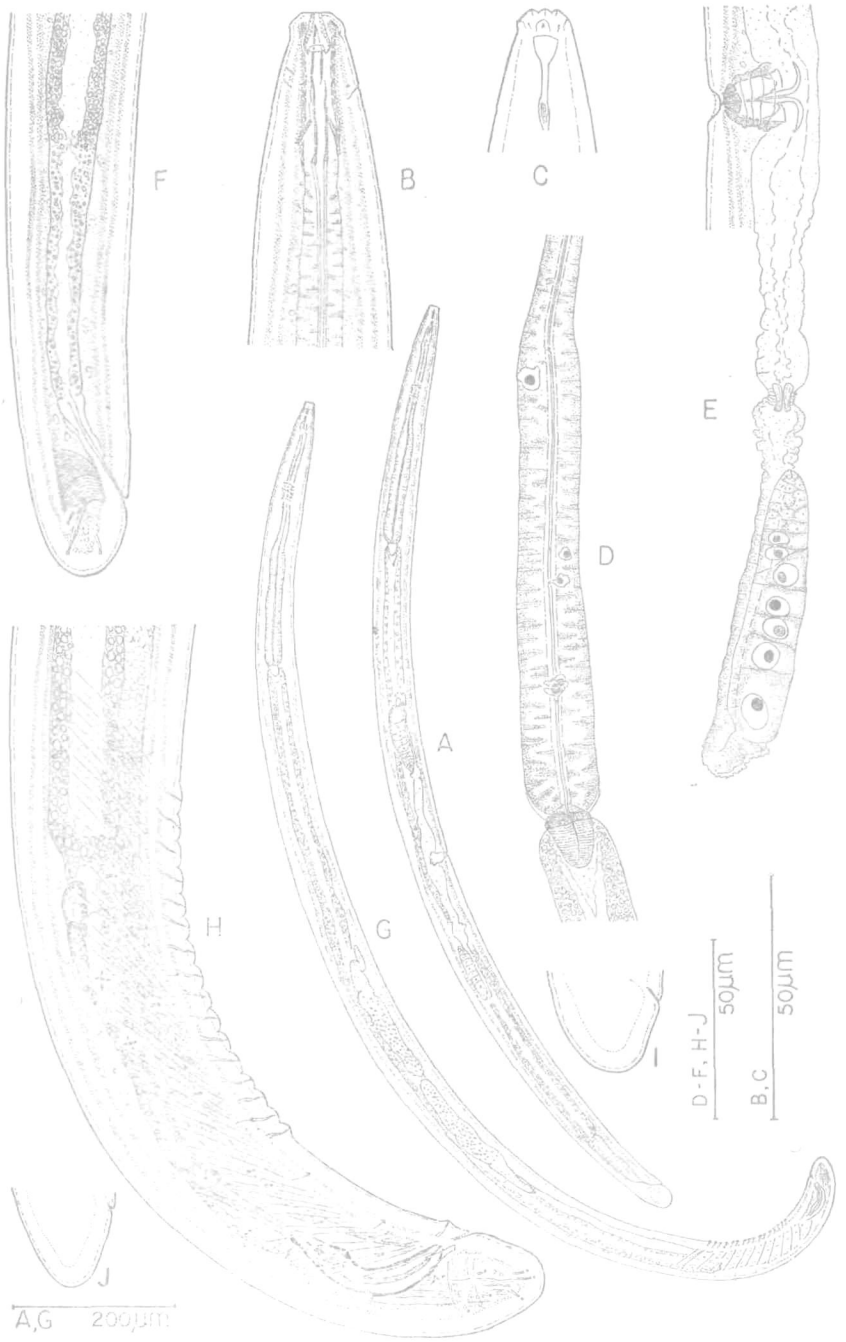

Fig. 2, A-J. *Thonus confusus* sp. n., A—Entire female; B—Anterior end of female; C—Surface view of anterior end; D—Basal expanded portion of oesophagus; E—Female reproductive system showing posterior sexual branch; F—Female tail; G—Entire male; H—Porterior region of male; I and J—Male tail showing variations.

Vulva situated in depression, longitudinal in ventral view. Vagina 21-23 μm or extending inward about half of the corresponding body-width, surrounded by sphincter, with moderately sclerotized distal region. Female reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Ovary reflexed, oocytes arranged in a single row except the growth region. Sperm not seen.

Tail obtusely rounded, 22-27 μm or about 0.8 anal body-width long, with 3-4 caudal pores on each side.

Male : Similar to female in general shape and morphology except the tail shape, more strongly curved in the posterior region and in male genital system. Supplements consist of an adanal pair and a series of 14-16 contiguous ventromedians. First ventromedian supplement situated at about 2 anal body-width from cloacal openinig. Subventral papillae 4-6, irregularly spaced. Spicules 47-52 μm or 1.5-1.7 anal body-width long medially. Lateral guiding pieces rod-shaped 11-13 μm long. Prerectum starts in the supplement region, 92-121 μm or 3-4 anal body-width long.

Tail bluntly rounded, in one specimen rounded conoid (Fig. 2, J), 22-23 μm or 0.7-0.8 anal body-width long, with four to five caudal pores on each side.

Type habitat and locality : Soil around roots of paddy, *Oryza sativa* L., from Dinhata, district Coochbehar, W. Bengal.

Type specimens : Holotype female along with a paratype male mounted on slide WN 462 and other paratypes on slide WN 463.

Differential diagnosis : *Thonus confusus* sp. n. comes close *T. major* Thorne, 1974 and *T. elegans* Thorne, 1974. From the former it differs in having differently shaped lip region, and tail, and different number and arrangement of ventromedian supplements in male (lip region distinctly offset, tail elongate hemispheroid and male with 9 regularly spaced ventromedian supplements in *T. major*). From *T. elegans* the new species differs in having differently shaped lip region, posteriorly situated vulva and shorter prerectum (lip region marked by a slight depression, V=47, and prerectum 4-6 anal body diameter in *T. elegans*).

*INDOKOCHINEMA EKRAMULLAHI** SP. N.

(Fig. 3)

Measurements :

14 ♀♀ (*Paratypes*) : L=1.10-1.38 mm; a=34-41; b=4.7-5.2; c=32-35; V=33-39$^{9-17}$.

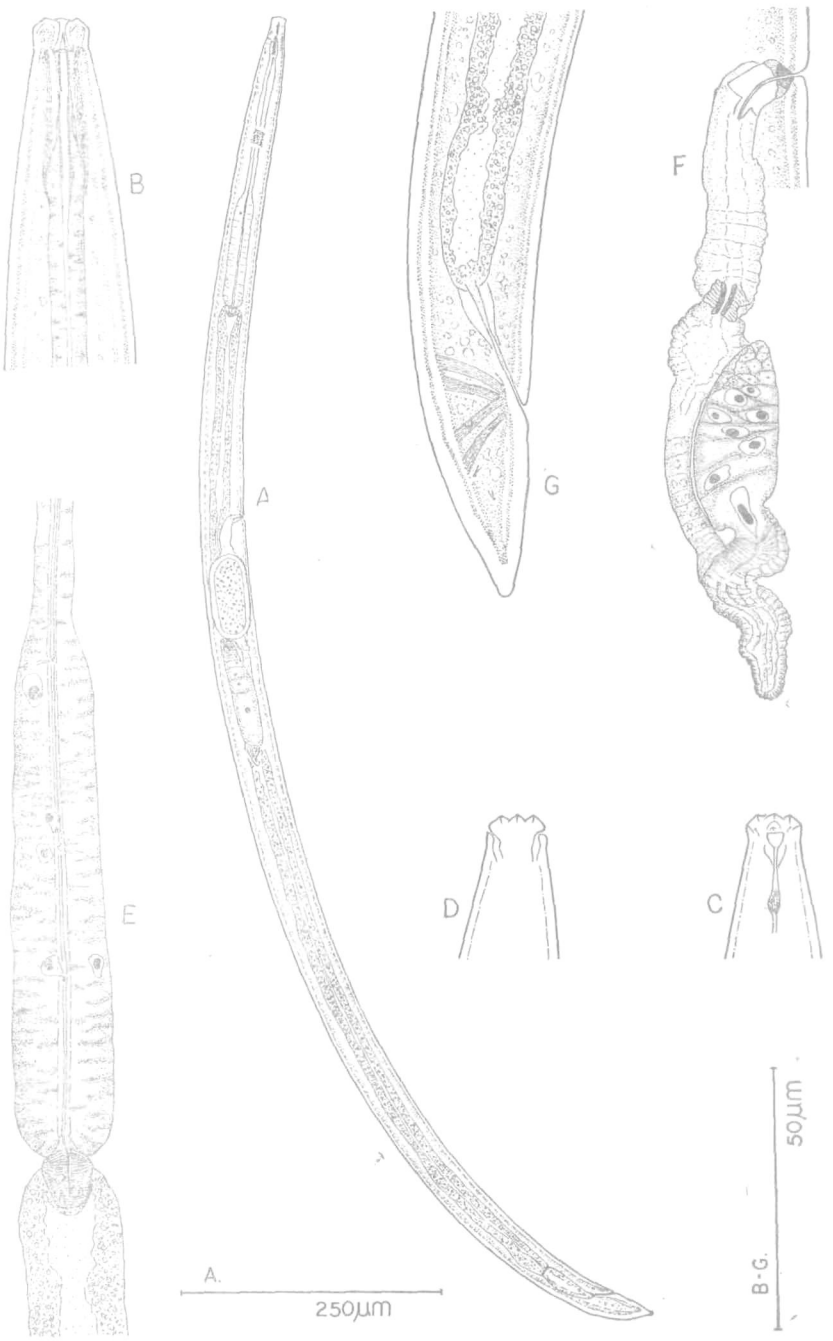

Fig. 3, A-G. *Indokochinema ekramullahi* sp. n., A—Entire female; B—Anterior end of female; C—Surface view of anterior end; D—Surface view of dorso-ventrally flattened specimen; E—Basal expended portion of oesophagus; F—Female reproductive system; G—Female tail.

Female (*Holotype*) : L=1.18 mm; a=36; b=4.9; c=31; V=36^{10}.

Description :

Female : Body ventrally curved upon fixation and tapering gradually towards both ends. Cuticle finely striated transeversely; its thickness more than 1 μm at mid-body and 3-6 μm at tail. Lateral chords $^1/_7$th-$^1/_6$th of the body-width near middle. Dorsal, ventral and lateral body pores indisitinct.

Lip region offset by a constriction, slightly wider than adjoining body, 1/2.7-1/2.5 of body-width at base of oesophagus. Amphids characteristically situated in the labial region, stirrup-shaped, apertures 3-3.5 μm or 30-33% of the corresponding body-width and about 3 μm from anterior end. Sensillar pouches 14-15 μm from amphidial slits.

Odontostyle 11-14 μm or 1.0-1.2 head-width long; aperture about 4 μm or 38-40% of the odontostyle length. Guiding ring 6-7 μm or 0.5-0.6 lip region-width from anterior end. Odontophore 15-17 μm or 1.1-1.3 times the odontostyle length. Basal expended part of oesophagus occupies 38-42% of the neck region. Locations of oesophageal gland nuclei and their orifices as follows :

DO=62.7-64.0 S_1N_1=72.5-74.7 S_2N=84.1-86.0
DN=66.2-67.5 S_1N_2=75.0-78.6 S_2O=86.6-87.5
DO-DN= 2.9-3.8
K=59.3-71.4 K′=69.0-78.5

Nerve ring at 94-112 μm or 42-45% of the neck region from anterior end. Cardia tongue-shaped, 11-13 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 29-38 μm or 1.3-1.8 anal body-width long. Rectum 23-25 μm or 1.0-1.2 anal body-width long.

Vulva a transverse slit. Vagina 12-15 μm long, sclerotized distally, inclined posteriorly. Female reproductive system mono-opisthodelphic. Anterior uterine sac absent. Uterus and oviduct separated by a sphincter. Ovary reflexed, oocytes arranged in a single row except in the region of multiplication.

Tail dorsally convex-conoid with rounded terminus, 32-39 μm or 1.5-1.7 anal body-width long, with 2-3 caudal pores on each side.

Male : Not found.

Type habitat and locality : Soil around roots of potato, *Solanum tuberosum*, at Kharbuni, district Birbhum, W. Bengal.

Type specimens : Holotype along with 5 paratypes mounted on slide WN 464 and other paratypes on WN 465-466.

Differential diagnosis : *Indokochinema ekramullahi* sp. n. differs from the type and only species *I. conicauda* Darekar and Khan, 1979 in having longer body, shorter oesophagus and tail, longer odontostyle and odontophore (L=0.71-0 82 mm; b=4.0-4 4; c=21-24, odontostyle 7-9 μm and odontophore 11-13 μm long in *I. conicauda*).

The authors are thankful to the Director, Zoological Survey of India, Calcutta for providing the research facilities. The financial assistance from I C.A R. under the All India Co-ordinated Research Project on Nematode Pests of Crops and their control is also acknowledged.

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NEMATODES FROM WEST BENGAL (INDIA) VIII. QUALITATIVE AND QUANTITATIVE STUDIES OF PLANT AND SOIL INHABITING NEMATODES ASSOCIATED WITH PADDY CROP IN BURDWAN DISTRICT

By

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(With 1 Text-figure)

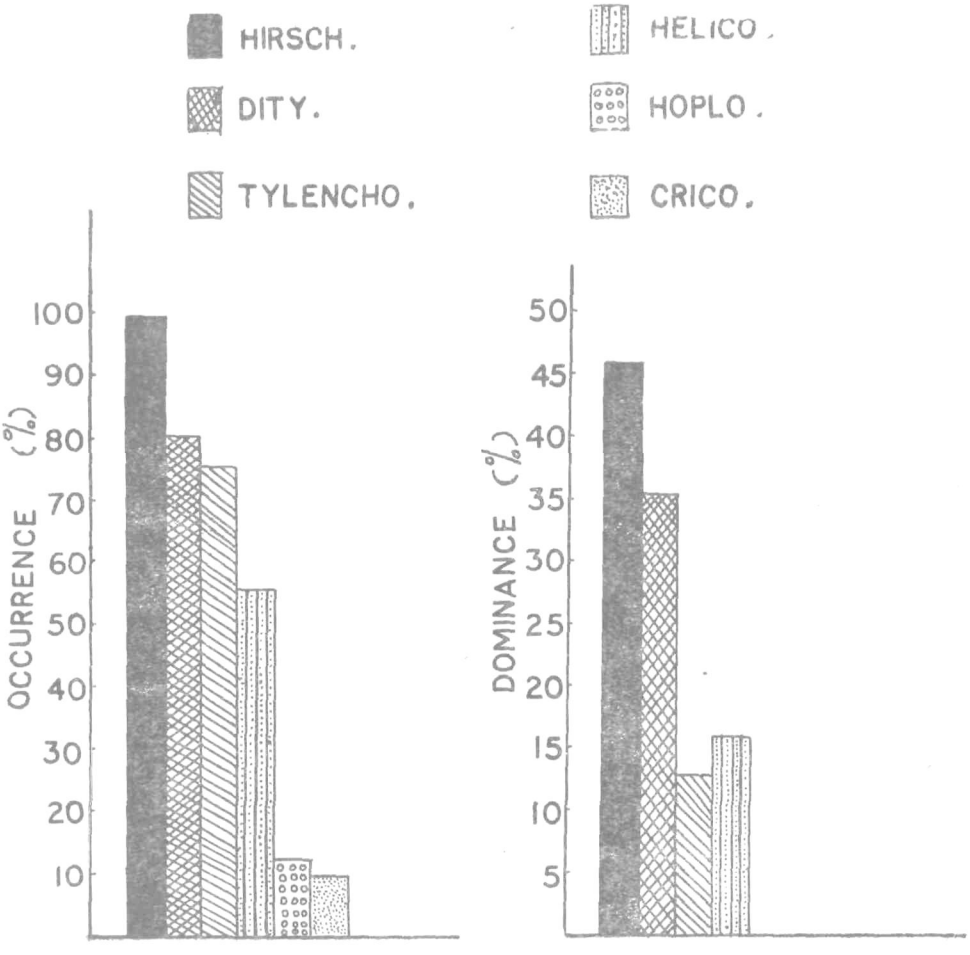
INTRODUCTION

This is the eighth paper of the series on "Nematodes from West Bengal (India)" which deals with the qualitative and quantitative studies of plant and soil inhabiting nematodes associated with paddy crop in Burdwan district of West Bengal. The present study was undertaken as a part of All India Co-ordinated Research Project on Nematode Pests of Crops and their Control, jointly sponsored by I. C. A. R. and D. S. T. during 1977-79. Since this type of studies provide useful informations regarding relative abundance and degree of dominance of different phytophagous nematodes, an intensive survey was therefore made during the month of December, 1977 at Memari, Jamalpur and Bursul Blocks of Burdwan district which is one of the major rice growing districts of West Bengal.

Despite an attempt to study the effect of soil texture on the occurrence and the dominance of different parasitic nematodes, their relationship could not be established in the present study. The results are being provided in the separate tables for each Block so that they may be helpful in future studies.

MATERIAL AND METHODS

The Head Quarter of each developmental block was made as centre and the survey was made in its North, South, West and East directions. In each direction, a village was selected and made centre. An attempt was made, subject to the availability of paddy crop, to take about 4 soil samples from each direction up to 2 Km from village centre. Several



Text-fig. 1

informations regarding management practices etc. were collected from the farmers to correlate these data in future studies.

For the quantitative study, the bulk of a sample was thoroughly mixed with hand and 100 gm of soil was taken separately for processing. This 100 gm soil was processed for the isolation of nematodes through the modified Baermann funnel technique. After 24 hours the counting was made thrice in a counting dish and the mean values were obtained. Only the commonly found nematodes were identified up to genera and counted separately under the stereoscopic microscope. The remaining nematodes were counted under the following groups : other tylenchids, other dorylaimids and saprophagous.

DETAILS OF SURVEY

1. BLOCK : MEMARI

Village Centre	Adjoinig localities	Soil samples collected from different Soil texture				Total No. of samples collected
		Sandy-loam	Clayey-loam	Clayey	Loam	
(a) Balut	(i) Balut	—	7	—	—	7
	(ii) Garaghata	—	2	—	—	2
	(iii) Kanaidanga	1	—	—	—	1
	(iv) Palla	—	1	—	—	1
	(v) Navagram	—	1	—	—	1
	(vi) Dolui Bazar	—	1	—	—	1
	(vii) Rasulpur Stn.	—	1	—	—	1
(b) Saldah	(i) Saldah	5	7	—	—	12
	(ii) Mahes danga Camp.	—	—	1	—	1
(c) Radhakantapur						
	(i) Radhakantapur	2	5	—	—	7
	(ii) Diamagra	—	1	—	—	1
	(iii) Balidanga	—	—	2	—	2
	(iv) Kamalpur	—	—	2	—	2
	(v) Munshidanga	—	—	1	—	1
(d) Shyamnagar						
	(i) Shyamnagar	—	—	3	—	3
	(ii) Kantapur	1	—	—	—	1
	(iii) Kantanagar	—	1	—	—	1
	(iv) Chotkhanda	1	1	—	—	2
	(v) Maghlampur	1	—	1	—	2

2. BLOCK : JAMALPUR

(a) Abujhati						
	(i) Abujhati	1	4	3	—	8
	(ii) Seromani	1	2	—	—	3
	(iii) Amra	2	—	—	—	2
(b) Autpara						
	(i) Autpara	4	4	—	1	9
	(ii) Bartika	2	—	—	—	2
	(iii) Dakshnpara	2	—	—	—	2
	(iv) Amtara	1	—	—	—	1
(c) Manirambati						
	(i) Manirambati	1	—	—	1	2
	(ii) Basantabati	1	—	—	—	1
	(iii) Madhavpur	1	1	—	—	2

Village Centre	Adjoining localities	Soil samples collected from different Soil texture				Total No. of samples collected
		Sandy-loam	Clayey-loam	Clayey	Loam	
(d) Choubaria						
	(i) Masagram	2	—	2	—	4
	(ii) Choubaria	1	1	—	2	4
	(iii) Saranpur Bartala	2	—	—	—	2
	(iv) Mear Ban	—	1	—	—	1
	(v) Panchra	3	—	—	—	3
3. BLOCK : BURSUL						
(a) Majherpara						
	(i) Majherpara	1	2	—	2	5
	(ii) Sonakur	—	—	—	2	2
	(iii) Krishnapur	—	—	—	1	1
(b) Ryan						
	(i) Ryan	—	7	1	—	8
	(ii) Nari	—	1	—	—	1
(c) Pamra						
	(i) Pamra	8	—	—	2	10
	(ii) Nandur	1	—	—	—	1

A. **Qualitative Study :**

The samples upon analysis yielded 18 parasitic species belonging to 13 genera, 9 families of the order Tylenchida and Dorylaimida. Besides, 18 soil inhabiting species have also been identified. The following is the list of parasitic nematode species arranged according to their systematic position.

Order TYLENCHIDA Thorne, 1949

Superfamily TYLENCHOIDEA (Orley, 1880) Chitwood & Chitwood, 1937.

Family TYLENCHIDAE Orley, 1880

Genus **Tylenchus** Bastian, 1865

T. davainei Bastian, 1865

T. filiformis Butschili, 1873

Genus **Ditylenchus** Filipjev, 1936

D. mirus Siddiqi, 1963

Family TYLENCHORHYNCHIDAE (Elieva, 1964) Golden, 1971.

Genus **Tylenchorhynchus** Cobb, 1913

T. mashhoodi Siddiqi & Basir, 1959

Family HOPLOLAIMIDAE (Filipjev, 1934) Wieser, 1953

Genus **Hoplolaimus** Daday, 1905

H. indicus Sher, 1963

H. columbus Sher, 1963

Genus **Helicotylenchus** Steiner, 1945

H. crenacauda Sher, 1966

H. retusus Siddiqi & Brown, 1964

Family PRATYLENCHIDAE (Thorne, 1949) Siddiqi, 1963

Genus **Hirschmanniella** Luc & Goodey, 1963

H. oryzae (Soltwedel, 1889) Luc & Goodey, 1963

H. gracilis (De Man, 1880) Luc & Goodey, 1963

Superfamily HETERODEROIDEA (Filipjev, 1934) Golden, 1971.

Family NACOBBIDAE (Chitwood & Chitwood, 1950) Golden, 1971.

Genus **Rotylenchulus** Linford & Oliveira, 1940

R. reniformis Linford & Oliveira, 1940

Superfamily CRICONEMATOIDEA (Taylor, 1936) Geraert, 1966

Family CRICONEMATIDAE (Taylor, 1936) Thorne, 1949

Genus **Macroposthonia** de Man, 1880

M. onoensis (Luc, 1959) De Grisse & Loof, 1965

M. ornata (Raski, 1958) De Grisse & Loof, 1965

Genus **Hemicriconemoides** Chitwood & Birchfield, 1957

H. cocophillus (Loos, 1949) Chitwood & Birchfield, 1957

Family PARATYLENCHIDAE (Thorne, 1949) Raski, 1962

Genus **Paratylenchus** Micoletzky, 1922

P. dianthus Jenkins & Taylor, 1956

Genus **Gracilacus** Raski, 1962

*G. janai** Baqri, 1979

Superfamily APHELENCHOIDEA (Fusch, 1937) Thorne, 1949

Family APHELENCHIDAE (Fusch, 1937) Steiner, 1949

Genus **Aphelenchus** Bastian, 1865

A. avenae Bastian, 1865

Order DORYLAIMIDA (De Man, 1876) Pearse, 1942

Superfamily DORYLAIMOIDEA (de Man, 1876) Thorne, 1934

Family LONGIDORIDAE (Thorne, 1935) Meyl, 1961

Genus **Paralongidorus** Siddiqi *et al.*, 1963

P. citri (Siddiqi, 1959) Siddiqi *et al.*, 1963

Apart from these parasitic nematode species, the following soil inhabiting nematode species belonging to the order Dorylaimida have also been identified :

1. *Ischiodorylaimus* n. sp.
2. *Thornenema mauritianum* (Williams, 1959) Baqri & Jairajpuri 1967
3. *Sicaguttur sartum* Siddiqi, 1971
4. *Medalinema coomansi** Baqri & Jana, 1980
5. *Jairajpuria shamimi** Baqri & Jana, 1980
6. *Aporcelaimellus heynsi* Baqri & Jairajpuri, 1968
7. *Aporcelaimellus tropicus** Jana & Baqri, 1981
8. *A. coomansi* Baqri & Khera, 1975
9. *Tylencholaimus pakistanensis* Timm, 1964
10. *Proleptonchus clarus* Timm, 1964
11. *Dorylaimoides elaboratus* Siddiqi, 1965
12. *Dorylaimoides parvus* Thorne & Swanger, 1936
13. *D. arcuicaudatus* Baqri & Jairajpuri, 1969
14. *Morasia bengalensis** Jana & Baqri, 1982
15. *Dorylaimellus discocephalus* Siddiqi, 1964
16. *Dorylaimellus indicus* Siddiqi, 1964
17. *Dorylaimellus deviatus* Baqri & Jairajpuri, 1968
18. *Neoactinolaimus thornei* Chaturvedi & Khera, 1979

The species marked with asterisk in the list have been reported earlier as new (Baqri, 1979 ; Baqri and Jana, 1980 ; Jana & Baqri, 1980 ; Baqri & Jana, 1981 ; and Jana & Baqri, 1982.). The male specimens of *Sicaguttur sartum*, Siddiqi 1971 have been reported for the first time.

B. Quantitative Study of Nematodes

1. BLOCK : MEMARI

Soil samples examined : 49

Nematodes	Per 100 gm of soil
Ditylenchus	20—510
Tylenchorhynchus	20—700
Helicotylenchus	10—530
Hirschmanniella	10—360
Macroposthonia	10— 80
Other Tylenchids	20—370
Other Dorylaimids	30—630
Saprophagous	40—370

Nematodes found from different types of soil in the Block Memari (per 100 gm of soil)

Nematodes	Sandy-loam		Clayey-loam		Clayey	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Ditylenchus	20	410	30	510	20	290
Tylenchorhynchus	20	300	10	200	20	700
Helicotylenchus	10	280	10	530	20	60
Hirschmanniella	80	220	10	280	20	360
Macroposthonia	10	80	10	—	—	—
Other Tylenchids	20	130	10	370	—	—
Other Dorylaimids	30	560	40	630	40	380
Saprophagous	80	360	60	370	40	210

2. BLOCK : JAMALPUR

Soil samples examined : 46

Nematodes	Per 100 gm of soil
Ditylenchus	20—2270
Tylenchorhynchus	10— 610
Hoplolaimus	10
Helicotylenchus	20— 240
Hirschmanniella	10— 290
Macroposthonia	10— 40
Rotylenchulus	50— 100
Other Tylenchids	30— 130
Other Dorylaimids	20—1200
Saprophagous	30— 400

Nematodes found from different types of soil in the Block Jamalpur (per 100 gm of soil)

Nematodes	Sandy-loam		Clayey-loam		Clayey		Loam	
	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum
Ditylenchus	20	2270	40	2050	80	1190	100	—
Tylenchorhynchus	10	610	10	100	20	110	70	—
Hoplolaimus	10	—	10	—	—	—	—	—
Helicotylenchus	20	240	10	40	40	70	—	—
Hirschmanniella	10	230	30	280	30	290	110	210
Macroposthonia	10	40	—	—	—	—	—	—
Rotylenchulus	50	100	—	—	—	—	—	—
Other Tylenchids	40	110	30	40	—	—	130	—
Other Dorylaimids	50	1200	110	410	20	700	160	270
Saprophagous	30	400	30	310	60	260	120	300

3. BLOCK : BURSUL (BURDWAN SADAR)

Soil samples examined : 29

Nematodes	Per 100 gm of soil
Ditylenchus	10—470
Tylenchorhynchus	20—290
Hoplolaimus	15—130
Helicotylenchus	20—240
Hirschmanniella	15—410
Macroposthonia	50
Paralongidorus	10
Other Tylenchids	10— 80
Other Dorylaimids	40—610
Saprophagous	20—230

Nematodes found from different types of soil in Block Bursul (per 100 gm of soil)

Nematodes	Sandy-loam		Clayey-loam		Clayey		Loam	
	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum
Ditylenchus	10	180	20	330	470	—	50	190
Tylenchorhynchus	20	160	30	100	220	—	290	—
Hoplolaimus	15	130	—	—	—	—	—	—
Helicotylenchus	240	—	20	40	110	—	50	110
Hirschmanniella	50	410	30	325	130	—	15	250
Macroposthonia	50	—	—	—	—	—	—	—
Paralongidorus	—	—	10	—	—	—	—	—
Other Tylenchids	20	40	30	80	—	—	10	20
Other Dorylaimids	40	380	50	610	140	—	150	320
Saprophagous	20	180	40	230	90	—	30	120

Among the plant parasitic nematodes, species of *Hirschmanniella* Luc & Goodey, 1963 were most abundant and present nearly in all the samples. *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 was found dominating over other parasitic species in 46% samples.

The occurrence of *Ditylenchus* spp., *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959 and *Helicotylenchus crenacauda* Sher, 1966 has been noted in 81%, 76% and 56% samples respectively. The *Ditylenchus* spp. were dominating in 36% samples. *Tylenchorhynchus mashhoodi* and *Helicotylenchus crenacauda* were generally present in small numbers but dominating in 13% and 16% samples respectively. The species of the genus *Hoplolaimus* Daday, 1905 has been recorded in 13% samples. The species of *Macroposthonia* de Man, 1880 and *Hemicriconemoides* Chitwood & Birchfield, 1957 were quite numerous in 10% samples (Text-fig. 1). The other parasitic species are less abundant.

The effect of soil texture on the relative abundance and degree of dominance of different parasitic nematode species remained inconclusive at this stage, but more intensive surveys in future would be certainly helpful in this regard.

SUMMARY

During the month of December, 1977 an intensive survey was made to study the relative abundance and degree of dominance of plant parasitic nematodes associated with paddy crop at Memari, Jamalpur and Bursul Blocks of Burdwan district in West Bengal. Upon analysis, 18 parasitic nematode species belonging to 14 genera and 9 families are being identified. In addition to these parasitic nematode species, 18 soil inhabiting nematode species have also been found. The list of species also includes the names of the following species and genera which have been found new to science in this collection : *Gracilacus janai* Baqri, 1979 ; *Ischiodorylaimus* n. sp., *Medalinema coomansi* Baqri & Jana, 1980 ; *Jairajpuria shamimi* Baqri & Jana, 1980 ; *Aporcelaimellus tropicus* Jana & Baqri, 1981 and *Morasia bengalensis* Jana & Baqri, 1982. The male specimens of *Sicaquttur sartum* Siddiqi, 1971 have been found for the first time. The present study also reveals that among the plant parasitic nematodes, *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 is the most abundant species and dominates in 46% samples in the area surveyed.

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ON THE LOCATIONS OF THE OESOPHAGEAL GLAND NUCLEI IN THE ORDER MONONCHIDA (NEMATODA)

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INTRODUCTION

Loof & Coomans (1968, 70) were the first to give an exhaustive and systematic account of oesophageal glands and their orifices in many species of different genera and families of the suborder Dorylaimina. Their study also included five species of mononchs because they were considered under Dorylaimina. Since then Loof & Jairajpuri (1968), Baqri & Jairajpuri (1969), Coomans & Loof (1970), Siddiqi (1969), Loof & Coomans (1972), Baqri & Coomans (1973) and others have contributed informations on this aspect and noted the consistency of these structures in different groups.

In the present work, an attempt has been made to provide informations, wherever possible, about the locations of oesophageal glands and their orifices in the species of Mononchida present in the National Collection of Zoological Survey of India and Department of Zoology, Aligarh Muslim University, Aligarh (U. P.). A total of 20 species belonging to 11 genera and 6 families of two suborders (Mononchina and Bathyodontina) have been studied. Since the order Mononchida includes only about 30 genera, the present study gives a good account of informations on the distribution of oesophageal gland nuclei and their orifices.

OBSERVATIONS

The general plan of nuclei and orifices in mononchs : The oesophagus in its posterior half consists of five (one celled) glands of different size and shape, i.e., one gland in the dorsal sector and four arranged in two pairs in the ventro-sublateral sectors. The nucleus/nucleolus of each gland becomes visible upon careful examination of the oesophagus.

The dorsal gland (DN) is the anterior most of the five, except in the members of suborder Bathyodontina where it may be situated even below the first pair of subventral glands. It is comparatively larger in size. The orifice of the dorsal gland (DO) is always well visible in the lumen anterior to dorsal gland (DN). The first pair of subventral glands (S_1N) are smaller in size and situated far below their orifices (S_1O). These two glands (S_1N) are located almost at the same level. The second pair of subventral glands (S_2N) is situated near the base of oesophagus or at about 90% or more of the oesophageal from anterior extremity. The orifices of the second pair (S_2O) are very close and generally situated slightly posterior to their glands but may be either at the level of S_2N or even far anterior. The S_2N are comparatively bigger than S_1N.

The locations are given below in percentage calculated from the total oesophageal length.

Suborder MONONCHINA

Family : MONONCHIDAE Chitwood, 1937

1. Genus **Mononchus** Bastian, 1865

1. 1. **Mononchus truncatus** Bastian, 1865

(Text-fig. 1)

Specimens observed : Four females. Total oesophageal length 382-415 μm. Location as follows :

DO=59.0-60.9	S_1O=69-73	S_2N=90-93
DN=62.5-66.2	S_1N=80-83	S_2O=93-94
DO-DN=3.6-5.5	S_1N-S_1O=8.8-10.6	

2. Genus **Prionchulus** (Cobb, 1917) Wu & Hoeppli, 1929

2. 1. **Prionchulus muscorum** (Cobb, 1917) Wu & Hoeppli, 1229

(Text-fig. 2)

Specimens observed : Five females. Total oesophageal length 412-442 μm. Locations as follows :

DO=56.6-58.4	S_1O=72-77	S_2N=94-95
DN=60.7-62.7	S_1N=83-88	S_2O=95-96
DO-DN=3.9-4.8	S_1N-S_1O=10.1-10.9	

2. 2. **Prionchulus longus** (Thorne, 1929) Andrassy, 1958

(Text-fig. 3)

Specimens observed : Two females. Total oesophageal length 554-567 μm. Locations as follows :

DO=53.2-55.0	S_1O=70-71	S_2N=94
DN=57.7-60.1	S_1N=80-81	S_2O=96
DO-DN=4.5-5.1	S_1N-S_1O=9.9-11.4	

3. Genus **Clarkus** Jairajpuri, 1970

3. 1. **Clarkus papillatus** (Bastian, 1865) Jairajpuri, 1970

(Text-fig. 5)

Specimens observed : Three females. Total oesophageal length 281-354 μm. Locations as follows :

DO=58.9-60.8	S_1O=72-74	S_2N=94-95
DN=65.2-66.9	S_1N=83-85	S_2O=95-96
DO-DN=4.8-6.1	S_1N-S_1O=10.5-10.6	

3. 2. **Clarkus sheri** (Mulvey, 1967) Jairajpuri, 1970

(Text-fig. 4)

Specimen observed : One female. Total oesophageal length 487 μm. Locations as follows :

DO=59.7	S_1O=71	S_2N=97
DN=62.4	S_1N=81	S_2O=98
DO-DN=2.7	S_1N-S_1O=10.3	

Family : COBBONCHIDAE Jairajpuri, 1969

4. Genus **Cobbonchus** Andrássy, 1958

4. 1. **Cobbonchus indicus** Baqri, Baqri & Jairajpuri, 1978

(Text-fig. 6)

Specimens observed : One female and one male. Total oesophageal length 324-325 μm. Locations as follows :

DO=54.1-55.2	S_1O=73-74	S_2N=93-94
DN=61.7-62.6	S_1N=85	S_2O=97
DO-DN=6.5-8.5	S_1N-S_1O=10.2-11.4	

Family : MYLONCHULIDAE Jairajpuri, 1969

5. Genus **Mylonchulus** (Cobb, 1916) Altherr, 1953

5. 1. **Mylonchulus nainitalensis** Jairajpuri, 1970

(Text-fig. 8)

Specimens observed : Three females. Total oesophageal length 283-314 μm. Locations as follows :

DO=56.6-57.6	S_1O=71-72	S_2N=91-93
DN=61.4-63.1	S_1N=81-83	S_2O=92-93
DO-DN=4.8-5.6	S_1N-S_1O=9.9-10.6	

5. 2. **Mylonchulus agriculturae** Coetzee, 1967

(Text-fig. 9)

Specimens observed : Three females. Total oesophageal length 310-389 μm. Locations as follows :

DO=56.1-56.8	S_1O=70-73	S_2N=90-93
DN=59.3-60.3	S_1N=78-81	S_2O=92-93
DO-DN=3.3-3.5	S_1N-S_1O=8.0-9.0	

5. 3. **Mylonchulus mulveyi** Jairajpuri, 1970

(Text-fig. 10)

Specimens observed : Five females. Total oesophageal length 287-322 μm. Locations as follows :

DO=53.1-56.4	S_1O=66-70	S_2N=90-93
DN=58.2-62.0	S_1N=76-79	S_2O=93-95
DO-DN=4.9-6.4	S_1N-S_1O=9.1-11.0	

5. 4. **Mylonchulus lacustris** (N. A. Cobb in M. V. Cobb, 1915) Andrássy, 1958

(Text-fig. 11)

Specimens observed : Four females. Total oesophageal length 321-390 μm. Locations as follows :

DO=50.1-55.3	S_1O=63-68	S_2N=90-93
DN=54.8-59.3	S_1N-74-78	S_2O=92-94
DO-DN=4.0-5.5	S_1N-S_1O=9.3-10.9	

5. 5. **Mylonchulus striatus** (Thorne, 1924) Andrássy, 1958

(Text-fig. 12)

Specimen observed : One female. Total oesophageal length 285 μm. Locations as follows :

DO=57.1	S_1O=70	S_2N=92
DN=63.5	S_1N=79	S_2O=92
DO-DN=6.4	S_1N-S_1O=8.7	

5. 6. **Mylonchulus brachyuris** (Butschili, 1873) Altherr, 1953

(Text-fig. 13)

Specimens observed : Two females. Total oesophageal length 338-342 μm. Locations as follows :

DO=58.7-59.0	S_1O=71	S_2N=90-91
DN=62.8-63.1	S_1N=79-84	S_2O=93
DO-DN=3.8-4.4	S_1N-S_1O=7.9-12.8	

6. Genus **Sporonchulus** (Cobb, 1917) Pennak, 1953

6. 1. **Sporonchulus ibitensis** (Carvalho, 1956) Andrassy, 1958

(Text-fig. 7)

Specimens observed : Four females. Total oesophageal length 261-294 μm. Locations of follows :

DO=58.9-62.2	S_1O=70-73	S_2N=91-94
DN=64.1-67.7	S_1N=82-87	S_2O=94-97
DO-DN=4.1-5.7	S_1N-S_1O= 9-15	

Family : ANATONCHIDAE Jairajpuri, 1969

7. Genus **Anatonchus** (Cobb, 1916) De Coninck, 1939

7. 1. **Anatonchus gynglymodontus** Mulvey, 1961

(Text-fig. 14)

Specimens observed : Two females and one male. Total oesophageal length 561-608 μm. Locations as follows :

DO=52.3-53.0	S_1O=69-71	S_2N=94
DN=56.1-57.1	S_1N=80-83	S_2O=95-96
DO-DN=3.1-4.8	S_1N-S_1O=10.2-13.0	

8. Genus **Miconchus** Andrássy, 1958

8. 1. **Miconchus thornei** Mulvey & Jensen, 1967

(Text-fig. 15)

Specimens observed : Two females. Total oesophageal length 439-516 μm. Locations as follows :

DO=49.6-52.1	S_1O=70-72	S_2N=93-94
DN=52.6-56.9	S_1N=80	S_2O=96
DO-DN=2.5-4.3	S_1N-S_1O=8-10	

Family : Iotonchidae Jairajpuri, 1969

9. Genus **Iotonchus** (Cobb, 1916) Altherr, 1950

9. 1. **Iotonchus longicaudatus** Baqri, Baqri & Jairajpuri, 1978

(Text-fig. 16)

Specimens observed : Four females. Total oesophageal length 259-305 μm. Locations as follows :

DO=52.5-55.4	S_1O=71-74	S_2N=92-94
DN=62.1-64.7	S_1N=82-84	S_2O=95-97
DO-DN=9.0-10.2	S_1N-S_1O=10.2-10.6	

9. 2. **Iotonchus brachylaimus** (Cobb, 1917) Andrassy, 1958

(Text-fig. 17)

Specimens observed : One female and two males. Total oesophageal length 547-647 μm. Locations as follows :

DO=47.2-50.5	S_1O=67-71	S_2N=91-93
DN=55.7-59.3	S_1N=79-84	S_2O=95-96
DO-DN=8.5-8.8	S_1N-S_1O=11-17	

9.3. **Iotonchus coomansi** Baqri, Baqri & Jairajpuri, 1978

(Text-fig. 18)

Specimens observed : Four females. Total oesophageal length 234-254 μm. Locations as follows :

DO=54.8-58.6	S_1O=70-71	S_2N=95-97
DN=62.1-64.1	S_1N=80-85	S_2O=96-97
DO-DN=6.0-7.5	S_1N-S_1O=12.8-15. 4	

The S_2N are either situated at the level of S_2O or slightly above.

10. Genus **Parahadronchus** Mulvey, 1978

10.1. **Parahadronchus shakili** (Jairajpuri, 1969) Mulvey, 1978

(Text-fig. 19)

Specimens observed : Three females and one male. Total oesophageal length 546-615 μm. Locations as follows :

DO=47.8-50.0	S_1O=66-69	S_2N=91-94
DN=56.3-58.6	S_1N=80-81	S_2O=94-96
DO-DN=6.3-9.2	S_1N-S_1O=11.7-13.3	

The species of the genera *Iotonchus* and *Parahadronchus* of the family Iotonchidae share a character that DN lies comparatively far behind DO, i.e., near about middle of DO-S_1O.

Suborder BATHYODONTINA

Family : MONONCHULIDAE (De Coninck, 1965)

11. Genus **Mononchulus** Cobb, 1918

11.1. **Mononchulus nodicaudatus** (v. Daday, 1901) Schneider, 1937

(Text-fig. 20)

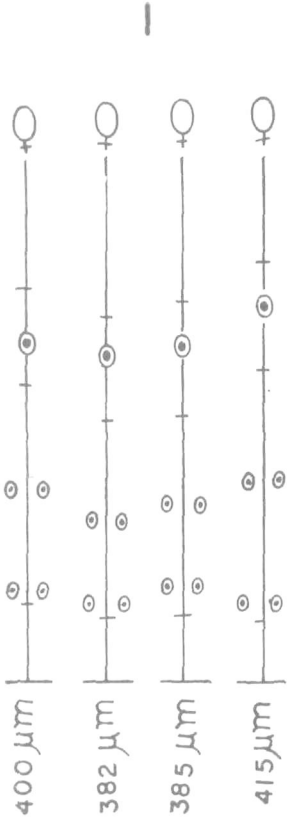
Specimens observed : Five females. Total oesophageal length 285-310 μm. Locations as follows :

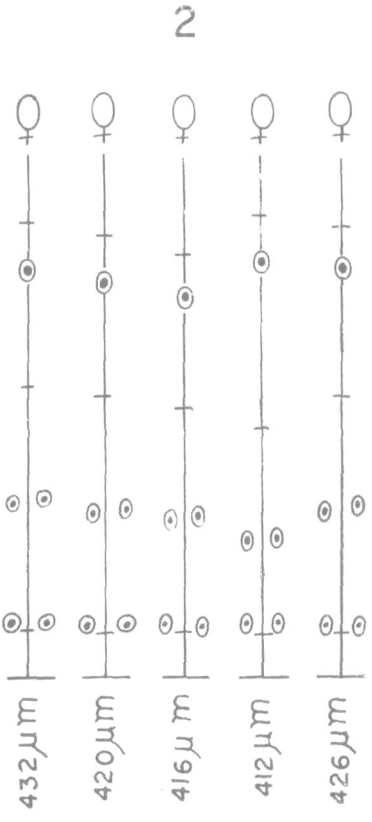
DO=46.4-53.3	S_1O=62-64	S_2N=91-93
DN=74.6-77.8	S_1N=76-77	S_2O=91-92
DO-DN=22.5-29.2	S_1N-S_1O=12.1-13.4	

The DN is far behind from DO, even slightly posterior to S_1N. The S_2N are either situated at level of S_2O or slightly below.

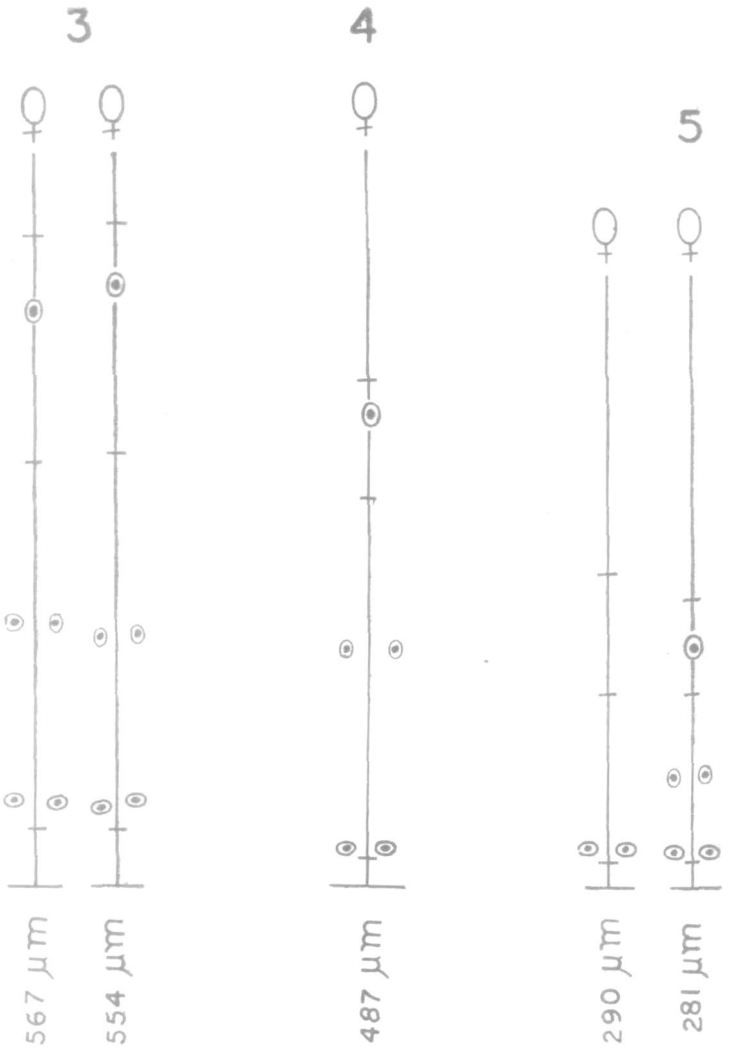
SUMMARY

The locations of oesophageal gland nuclei and their orifices have been studied in 20 species belonging to 11 genera, 6 families of the order Mononchida. The distance between S_1O and S_1N is about 10% or more of the total oesophageal length. The dorsal gland (DN) lies between DO and S_1O in the suborder Mononchina whereas in the suborder Bathyodontina, family Mononchulidae, the DN is always situated posterior to S_1O at about the level of S_1N. In the species of the genera *Iotonchus* and *Parahadronchus*, family Iotonchidae, DN is comparatively located far behind from DO, i. e., near the middle of DO-S_1O.

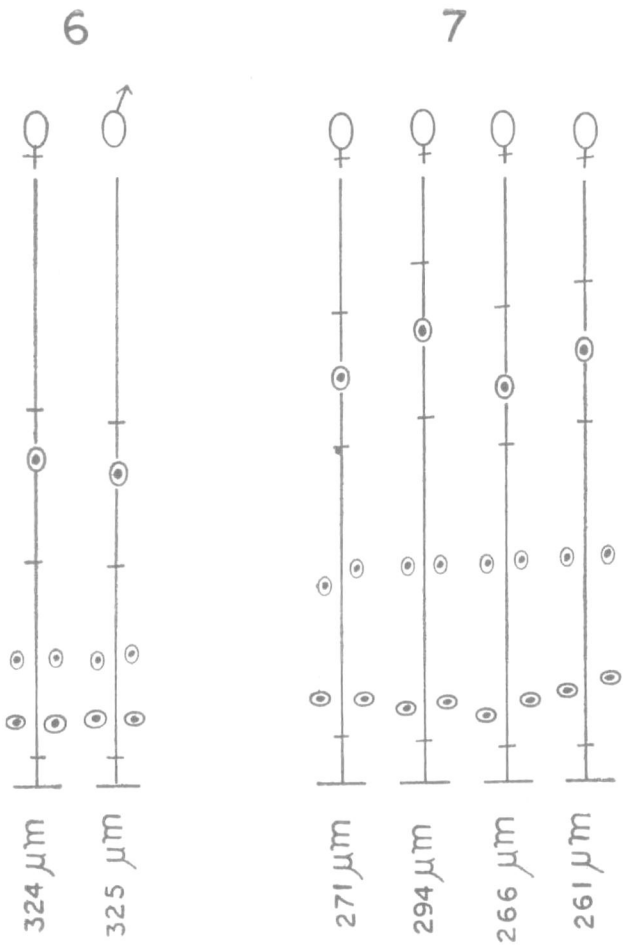




Text-fig. 1. *Monochus truncatus* ; Text-fig. 2. *Prionchulus muscorum.*



Text-fig. 3. *Prionchulus longus* ; Text-fig. 4. *Clarkus sheri* ; Text-fig. 5. *Clarkus papillatus*.



Text-fig. 6. *Cobbonchus indicus* ; Text-fig. 7. *Sporonchulus ibitensis.*

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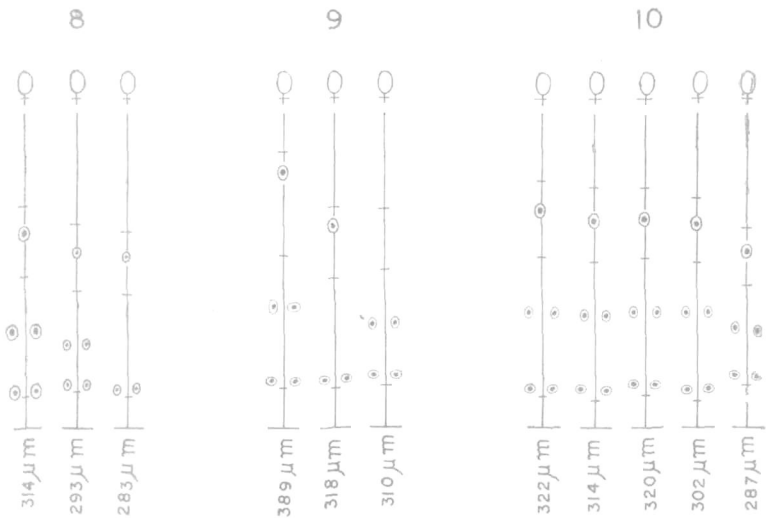
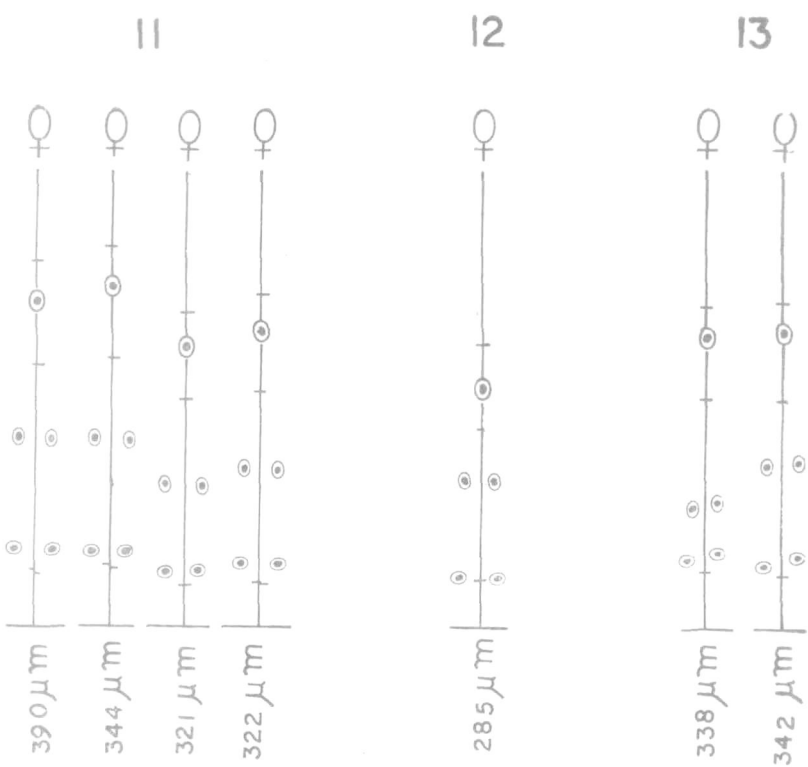
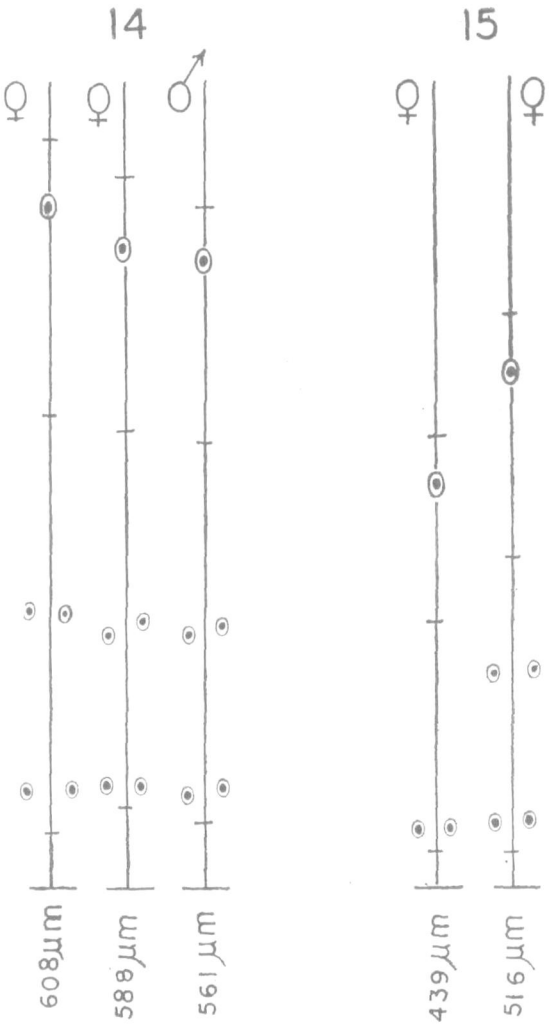


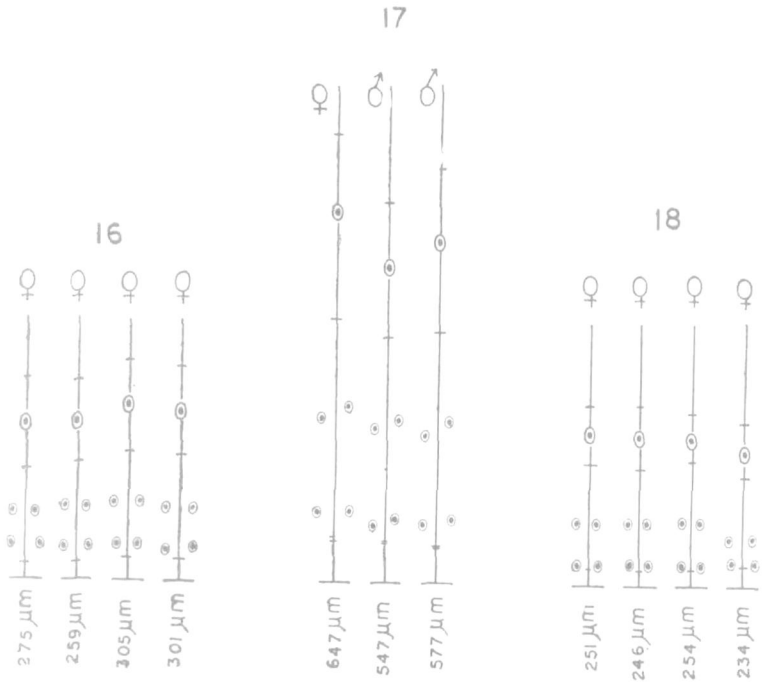
Text-fig. 8. *Mylonchulus nainitalensis* ; Text-fig. 9. *Mylonchulus agriculturae* ; Text-fig. 10. *Mylonchulus mulveyi.*



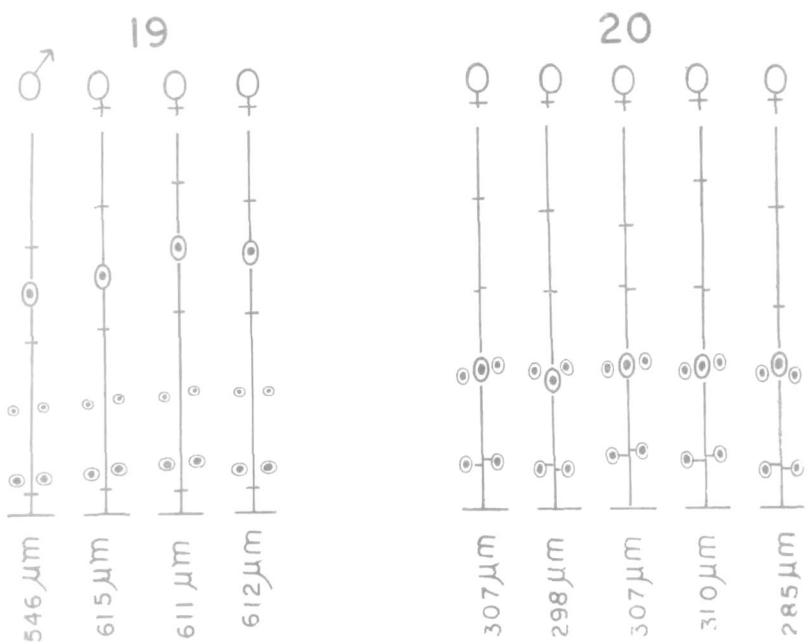
Text-fig. 11. *Mylonchulus lacustris* ; Text-fig. 12. *Mylonchulus striatus* ; Text-fig. 13. *Mylonchulus brachyurus.*



Text-fig. 14. *Anatonchus gynglymodontus* ; Text-fig. 15. *Miconchus thornei.*



Text-fig. 16. *Iotonchus longicaudatus* ; Text-fig. 17. *Iotonchus brachylaimus* ; Text-fig. 18. *Iotonchus coomansi.*



Text-fig. 19. *Parahadronchus shakili* ; Text-fig. 20. *Mononchulus nodicaudatus.*

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NEMATODES FROM WEST BENGAL (INDIA)
XVI. ON THE SPECIES OF THE GENUS *HELICOTYLENCHUS* STEINER, 1945 (HOPLOLAIMIDAE : TYLENCHIDA)

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INTRODUCTION

Nematodes of the genus *Helicotylenchus* have been reported from West Bengal in two previous articles : Chaturvedi & Khera (1979) reported *H. indicus* Siddiqi, 1963 from Howrah and 24-Parganas districts, *H. retusus* Siddiqi & Brown, 1964 from Midnapur district, and a new species *H. indentatus* (=*H. crenacauda* Sher, 1966) from Burdwan district. Singh & Khera (1980) added two new species, *H. seshadrii* (=*H. paraplatyurus* Siddiqi, 1972) and *H. belurensis* (=*H. microcephalus* Sher, 1966), from Howrah district.

Present paper reports eight species of *Helicotylenchus* Steiner, 1945, out of which the following species are being reported for the first time form West Bengal : *H. dihystera* (Cobb, 1893) Sher, 1961 ; *H. multicinctus* (Cobb, 1893) Golden, 1956 ; *H. erythrinae* (Zimmermann, 1904) Golden, 1956 ; and *H. abunaamai* Siddiqi, 1972. *Helicotylenchus dihystera* has been found widely distributed at Darjeeling, Jalpaiguri and Coochbehar districts while *H. crenacauda* is abundant at Burdwan district *Helicotylenchus multicinctus, H. erythrinae, H. retusus, H. microcephalus (=H. belurensis), H. paraplatyurus (=H. seshadrii)* and *H. abunaamai* are poorly represented in West Bengal.

It is known (Sher, 1966 ; Nandakumar & Khera, 1970 ; Siddiqi, 1972 ; Yeates, 1973 ; Ali, Geraert & Coomans, 1973 ; Sauer & Winoto, 1975 ; Geraert, 1976 ; Ali, 1976 ; Van den Berg 1978 ; Azmi & Jairajpuri, 1978 ; Fortuner, 1979 ; Fortuner & Queneherve, 1980 ; Fortuner, Merny & Roux, 1981) that *Helicotylenchus* spp. are variable. Sauer & Winoto (1975) have correctly pointed out that the taxonomy of *Helicotylenchus* has become difficult because of the variability of characters used for identification at specific level. Hence, a number of populations of a species should be studied. Many authors do not take enough consideration on this variability when describing new species. This results in badly described or invalid species.

In this paper, we wish to add to the knowledge of variability of *Helicotylenchus* and comment on the status of some of its species.

MATERIAL AND METHOD

Origin of the specimens : **Table I**

Species	Population Number	No. of specimens	Host name	Locality (dist.)	Remark
H. dihystera	1.	7 ♀♀ ++	Maize (*Zea mays* L.)	Darjeeling (Proper)	
	2.	4 ♀♀ ++	Tea (*Thea sinensis* L.)	Lebong (Darjeeling)	
	3.	8 ♀♀ ++	Banana (*Musa* sp.)	Phoolsering (Darjeeling)	
	4.	7 ♀♀ ++	Tea (*Thea sinensis* L.)	Kurseong (Darjeeling)	
	5.	10 ♀♀ ++	Banana (*Musa* sp.)	Shaktigarh (Darjeeling)	
	6.	5 ♀♀ ++	Tea (*Thea sinensis* L.)	Dagapur Tea Estate (Darjeeling)	
	7.	3 ♀♀ ++	Banana (*Musa* sp.)	Matigarh (Darjeeling)	
	8.	6 ♀♀ ++	Banana (*Musa* sp.)	Collegepara (Jalpaiguri)	
	9.	4 ♀♀ ++	Banana (*Musa* sp.) and Mango (*Mangifera indica* L.)	Dakshingwrihati (Coochbehar)	
	10.	3 ♀♀ ++	Banana (*Musa* sp.) and Paddy (*Oryza sativa* L.)	Dakshinkala Roy (Coochbehar)	
H. multicinctus	1.	11 ♀♀ ++	Maize (*Zea mays* L.)	Darjeeling (Proper)	
H. erythrinae	1.	8 ♀♀ ++	Tea (*Thea sinensis* L.)	Darjeeling (Proper)	
H. retusus	1.	3 ♀♀ ++	Paddy (*Oryza sativa* L.)	Krishnapur and Majherpara (Burdwan)	
H. microcephalus (=*H. belurensis*)	1.	5 ♀♀ ++	Sponge gourd (*Luffa cylindrica* Roem)	Belur (Howrah)	5 paratypes of *H. belurensis*
H paraplatyurus (=*H. seshadrii*)	1.	7 ♀♀ ++	Okra (*Abelmoschus esculentus* (L.) Moench)	Belur (Howrah)	7 paratypes of *H. seshadrii*
H. abunaamai	1.	5 ♀♀ ++	Cabbage (*Brassica oleracea* L.)	Kharbani (Birbhum)	
H. crenacauda	1.	96 ♀♀ ++	Paddy (*Oryza sativa* L.)	Burdwan sadar (Burdwan)	
		4th stage juv. 7	—do—	—do—	

All the specimens included in this study have been deposited in the National Collection of Zoological Survey of India, Calcutta, India.

Helicotylenchus dihystera (Cobb, 1893) Sher, 1961

(Fig. 1, A—D & Fig. 2)

Measurements : Table II.

Description :

Lip region continuous, hemispherical, marked by 4-5 annules. Anterior cephalids not seen, posterior cephalids 6-7 annules below the lip region. Lateral fields not areolated except in one specimen from Dakshinkala Roy population where it is areolated in the oesophageal region. Stylet knobs flattened (44% of the specimens) or indented (56%) anteriorly. Excretory pore slightly anterior or posterior to the anterior end of the oesophageal glands. Hemizonid 0-2 annules anterior to excretory pore, 2 annules long. Spermatheca rounded, offset, without sperm. Tail dorsally curved, with slightly ventral projection in 72% of the specimens (Fig. 1, D); projection absent in the other specimens (Fig. 1, C). The fusion of the inner incisures at the tail tip is noted U shaped in 36% while in other V or Y shaped.

The length of stylet, oesophagus and tail are not significantly correlated with body lenght. The Coefficients of Correlation are respectively R = 0.678, 0.042 and 0.746. There is a significant correlation between position of median oesophageal bulb (R = 0.689) and vulva (R = 0.949) with the body length. Fig. 2 presents body length in relation to position of median bulb and vulva.

Remarks :

This species is cosmopoliton in distribution. Its body dimensions show a high degree of variations. The present populations have been identified as *H. dihystera* because of hemispherical head, tail shape and offset spermatheca without sperm. The body dimensions and different measurements have been found well within the range reported by Sher (1966) and Siddiqi (1972) in topotypes. As far as the U shaped and Y shaped fusion of inner incisures at tail tip is concerned, Ali *et al.*, (1973) and Sauer & Winoto (1975) have already illustrated V shaped to Y shaped fusion of inner incisures at tail. They have also mentioned that the fusion of the inner lines in *H. dihystera* is variable. Siddiqi (1972) has also illustrated Y shaped fusion of the inner lines in topotype females (Fig. 1, D).

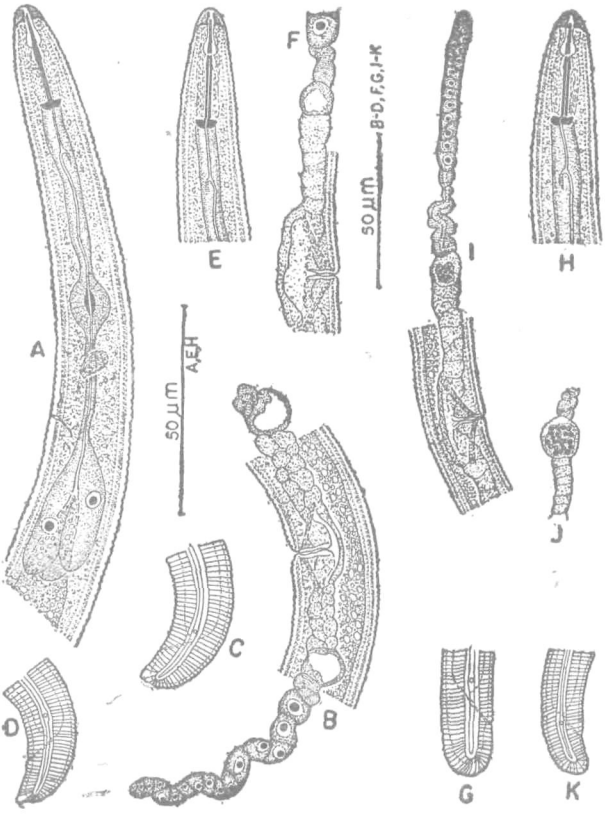

Fig. 1. *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961 (A—D) : A : Oesophageal region ; B : Female anterior reproductive system ; C & D : Female tails. *H. retusus* Siddiqi & Brown, 1964 (E—G) : E : Anterior end ; F : Part of female reproductive system ; G : Female tail. *H. multicinctus* (Cobb, 1893) Golden, 1956 (H-K): H : Anterior end ; I : Anterior female reproductive system ; J : Spermatheca filled with sperm ; K : Female tail.

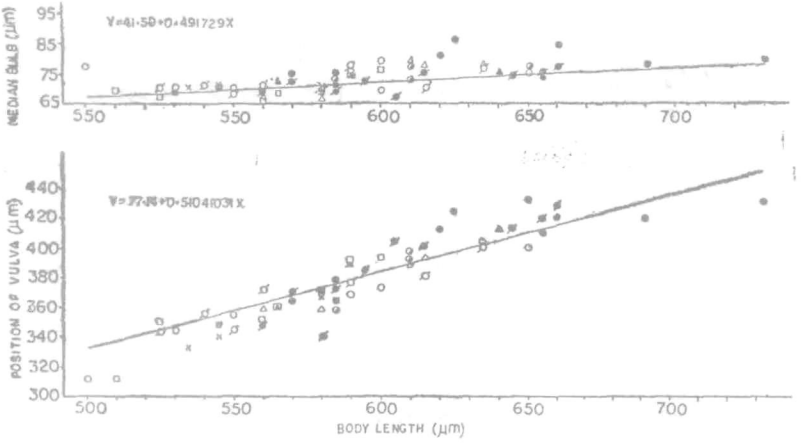

Fig. 2. *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961 Body length in relation to position of median bulb and position of vulva.

a = Darjeeling population, b = Lebong population,
c = Phoolsering population, d = Kurseong population,
e = Shaktigarh population, f = Dagapur population,
g = Matigarh population, h = Collegepara population,
i = Dakshingwrihati population, j = Dakshinkala Roy population.

Note—a-(represents bellow circle), b-(represents circle halfsolid), c (represents solid circle), d-(represents bellow circle with arms) e-(represents solid circle with arms). f-represents hollow triangle), g-(represents solid triangle), h-(represents hollow square), i-(represents solid square), j-(represents cross).

Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956

(Fig. 1, H - K)

Measurements :

Females (11) : L (mm) = 0.54 (0.49-0.59) SD = 0.04; a = 27(23-31) SD=2.25; b=5.3(4.9—6.0) SD = 0.40; b' = 4.4(4.0—4.9) SD = 0.34; c = 45 (38—52) SD = 4.6; c' = 1.02(0.9—1.2) SD = 0.10; V = 68(64—70), SD = 1.83; stylet (μm) = 24(23—25) SD = 0.60; m = 47(46—48) SD = 1.04; O=37 (33—38) SD = 2.54.

Male : Not found.

Description :

Lip region hemispherical, continuous with body, marked by 4-5 annules. Anterior and posterior cephalids not seen. Stylet knobs indented anteriorly. Excretory pore anterior to oesophago-intestinal junction. Hemizonid at the level of excretory pore, 1-2 annules long. Spermatheca offset, filled with sperm. Tail more curved dorsally, terminus hemispherical, with 10-14 annules ventrally. Phasmids 3-4 annules anterior to anus.

Remarks :

Our specimens of *H. multicinctus* from West Bengal agree with the description of its topotype females provided by Sher (1966) and Siddiqi (1973) in having same body dimensions, stylet length, rounded head with slight depression terminally, spermatheca filled with sperms and tail shape.

Helicotylenchus erythrinae (Zimmermann, 1904) Golden, 1956

(Fig. 3, A—D)

Measurements :

Females (8) : L (mm)=0.49 (0.46-0.57) SD=0.14 ; a=23 (21-28) SD=2.45 ; b=5.2 (4.9-5.5) SD=0.27 ; b'=4.3 (4.1-5.5) SD=0.18 ; c=29 (27-31) SD=3.46 ; c'=1.35 (1.2-1.5) SD=0.13 ; V=62 (61-63) SD=0.83 ; stylet (μm)=22.3 (22-23) SD=0.46 ; m=48 (45-60) SD=2.33 ; O=39 (37-40) SD=2.12.

Male : Not found.

Description :

Lip region hemispherical, marked by 4-5 annules. Anterior cephalids indistinct, posterior cephalids 7-8 annules below the lip region. Stylet knobs indented anteriorly. Excretory pore anterior to oesophago-intestinal junction. Hemizonid 0-2 annules from excretory pore, 2 annules long. Spermatheca offset, filled with sperm. Tail dorsally curved, tapering gradually to a conspicuous ventral projection with a pointed tip. Phasmids 1-3 annules anterior to anus.

Remarks :

The present population identified as *H. erythrinae* resembles with its topotypes described by Sher (1966) in having same body dimensions, shape of head, number of head annules, length of stylet, functional spermatheca and tail with a pronounced ventral projection. However, the West Bengal specimens have slightly robust tail projection than reported by Sher (1966) in topotypes and Sauer & Winoto (1975) in Malaysia population. Apart from this, Sher (l. c.) has also reported the position of phasmids 2 annules posterior to 4 annules anterior to anus. Perhaps he could study more variation because he was having more specimens.

Helicotylenchus retusus Siddiqi & Brown, 1964

(Fig. 1, E—G)

Measurements :

Females (3) : L (mm) = 0.82 (0.71—0.89) SD=0.09 ; a=30 (28-32) SD=2.0 ; b=6.9 (6.3-7.3) SD=0.51 ; b'=5.8 (5.2-6.2) SD=0.51 ; c=58 (53-61) SD=4.16 ; c'=0.97 (0.9-1.0) SD=0.06 ; V=62 ; stylet (μm)=26 (25-27) SD=1.04 ; m=47.6 (47-48) SD=0.58 ; O=38 (35-42) SD=3.51.

Description :

Body 'C' shaped upon fixation. Lip region hemispherical, with indistinct annulation. Anterior and posterior cephalids not seen. Stylet knobs flattened to indented anteriorly. Excretory pore at the level of oesophago-intestinal junction or anterior. Hemizonid one annule anterior to excretory pore, 2 annules long. Spermatheca without sperm. Tail terminus hemispherical, symmetrical, marked by 10-14 annules ventrally. Phasmids 9-12 annules anterior to anus.

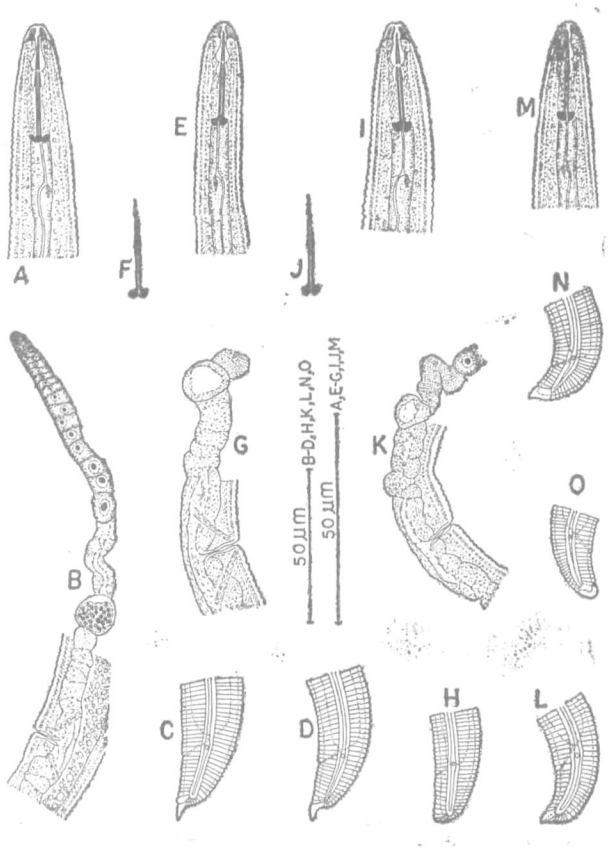

Fig. 3. *H. erythrinae* (Zimmermann, 1904) Golden, 1956 (A—D) : A : Anterior end ; B : Anterior female reproductive system ; C & D : Female tails. *H. paraplatyurus* Siddiqi, 1972 (E—H): E : Anterior end ; F : Stylet ; G : Part of female reproductive system ; H : Female tail, *H. microcephalus* Sher, 1966 (I—L) : I : Anterior end ; J : Stylet ; K : Part of female reproductive system ; L : Female tail. *H. abungamai* Siddiqi, 1972 (M—O) : M : Anterior end ; N : Normal female tail ; O : Female tail showing variation.

Remarks :

The West Bengal population fits well with the original description of *H retusaus* provided by Siddiqi & Brown (1964) except in having 'C' shaped body upon fixation. Siddiqi & Brown (l. c.) have reported spiral shaped body while Sher (1966) has reported 'C' shaped body in Cebu population from Philippines and Mysore population from India.

Helicotylenchus microcephalus Sher, 1966

Syn. *Helicotylenchus belurensis* Singh & Khera, 1980, new synonymy

(Fig. 3, I—L)

Measurements :

Female (5) : L (mm)=0.63 (0.62-0.70) SD=0.02 ; a=30 (27-31) SD=1.67 ; b=5.8 (5.0-6 3) SD=0.48 ; b'=4.7 (4.3-5.0) SD=0.25 ; c=40 (32-41) SD=2.19 ; c'=1.16 (1.1—1.4) SD=0.05 ; V=61 (61—63) SD=0.70 ; Stylet (μm) = 24 (23—25) SD=0.85 ; m=48 (47—50) SD=1.09 ; O=43 (41—46) SD=2.51.

Description :

Lip region continuous, truncated marked by indistinct annules. Anterior and posterior cephalids not seen Lateral fields not areolated, incisures smooth. Stylet knobs anteriorly indented. Excretory pore at the level of oesophago-intestinal junction or anterior. Hemizonid 1-2 annules anterior to excretory pore, 2 annules long. Spermatheca offset. without sperm. Tail more curved dorsally, tapering to form a projection, marked by 11—14 annules ventrally. Phasmids 2-4 annules anterior to anus.

Discussion :

Helicotylenchus belurensis was described by Singh & Khera (1980) and distinguished from *H. microcephalus* by the following characters : "the outer margin of lateral field being aerolated, the outer incisures being crenate and the inner two incisures not fusing on the tail, spermatheca being filled with sperm and value of c." Our study of 5 paratype females, from the National Collection of Zoological Survey of India, reveals that the outer bands of the lateral fields are non-areolated, the outer incisures are smooth throughout the whole length, and the spermatheca is offset but without sperm. The value of c is 32-41 in the type specimens (c=44-48 after Singh & Khera, 1980). Now the only distinguishing character

of *H. belurensis* remains that the inner incisures do not fuse in the tail region. In view of recent reports (Nandakumar & Khera, 1970 ; Siddiqi, 1972 ; Ali *et al.*, 1973 ; Sauer & Winoto, 1975 ; and others including the present study of *H. dihystera*, (Fig. 1-C & D) regarding the variability in the pattern of termination of inner two incisures in the genus *Helicotylenchus*, this single character can not be treated as of diagnostic importance. The study of these specimens confirm that *H. belurensis* is morphologically identical of *H. microcephalus*. Hence, *H. belurensis* is here proposed as new synonym of *H. microcephalus*.

Helicotylenchus paraplatyurus Siddiqi, 1972

Syn. *Helicotylenchus seshadrii* Singh & Khera, 1980, new synonymy

(Fig. 3, E—H)

Measurements :

Females (7) : L (mm)=0.65 (0.58—0.70) SD=0.38 ; a=30 (27—32) SD=1.83 ; b=5.7 (5.6—6.6) SD=0.31 ; b'=4.8 (4.6—5.1) SD=0.20 ; c=43 (41—45) SD=1.60 ; c'=1.24 (1.1—1.3) SD=0.08 ; V=64 (63—65) SD=0.69 ; stylet (μm)=23 (22—24) SD=0.53 ; m=47 (45—48) SD=1.29 ; O=41 (38—46) SD=3.77.

Description :

Lip region continuous, broadly rounded, with 4—5 annules. Anterior and posterior cephalids not distinct. Lateral fields with smooth incisures Stylet knobs indented anteriorly. Excretory pore slightly anterior or posterior to the oesophago—intestinal junction. Hemizonid 2—4 annules anterior to excretory pore, 2 annules long. Female reproductive system typical of the genus, spermatheca offset, without sperm. Tail subcylindrical, with broadly rounded terminus, marked by 11—16 annules. Phasmids from 2 annules posterior to 4 annules anterior to the anus.

Discussion :

Singh & Khera (1980) separated *H. seshadrii* from *H. paraplatyurus* on the following characters : Conspicuously indented stylet knobs (stylet knobs alomst anchor- shaped against rounded to occasionally indented anteriorly in *H. paraplatyurus*), greater value of b (b=6.2—7.4 against 5.1—6.5 in *H paraplatyurus*), and shape of tail (tail cylindrical and

more curved dorsally with hemispherical terminus against dorsally convex, subcylindroid to broadly rounded terminus in *H. paraplatyurus*).

In fact, the stylet knobs in the 7 paratypes of *H. seshadrii* are slightly indented anteriorly and not anchor-shaped (Fig. 3, E & F) and the range of b value has been calculated 5.6—6.6 by us. The shape of the tail and termination of the inner two incisures in tail region of *H. paraplatyurus* have been illustrated variable by Siddiqi (1972). *H. seshadrii* is here proposed as a new synonym of *H. paraplatyurus*.

Helicotylenchus abunaamai Siddiqi, 1972

(Fig. 3 , M—O)

Measurements :

Females (5) : L (mm)=0.51 (0.49—0.55) SD = 0.03 ; a=23 (21—24) SD=1.30 ; b=5.2 (4 9 –5 9) SD=0.42 ; b'=4.4 (4.3– 4.8) SD = 0.24 ; c = 41 (36—50) SD=6.61 ; c'=1.06 (0.8—1.3) SD=0.19 ; V=62 (60—65) SD=1.92 ; stylet (μm)=21.6 (21—22) SD=0.48 ; m = 48.4 (48=50) SD=0 89 ; O=40 (38– 42) SD=2.0.

Description :

Lip region continuous, broadly rounded, with 4 annules. Anterior and posterior cephalids not seen. Stylet knobs slightly indented anteriorly. Excretory pore anterior to oesophago-intestinal junction. Hemizonid 0-1 annule anterior to excretory pore, 2 annules long. Spermatheca without sperm. Tail ventrally concave and dorsally conve, with an unstriated ventral projection (Fig. 3, N), rounded terminus in one specimen (Fig 3, O); inner incisures of lateral fields fusing distally (Y shape) in tail region. Phasmids 3-4 annules anterior to anus.

Remarks :

The West Bengal population identified as *H. abunaamai* is similar to the type population described by Siddiqi (1972) from Central Sudan in the body dimensions and measurements, head and tail shape, stylet length and spermatheca without sperm. The specimens reported by Sauer & Winoto (1975) from West Malaysia differ from the types described by Siddiqi in having ventral projection with narrow rounded tip on tail (tail with a slight projection having hemispherical terminus in type population).

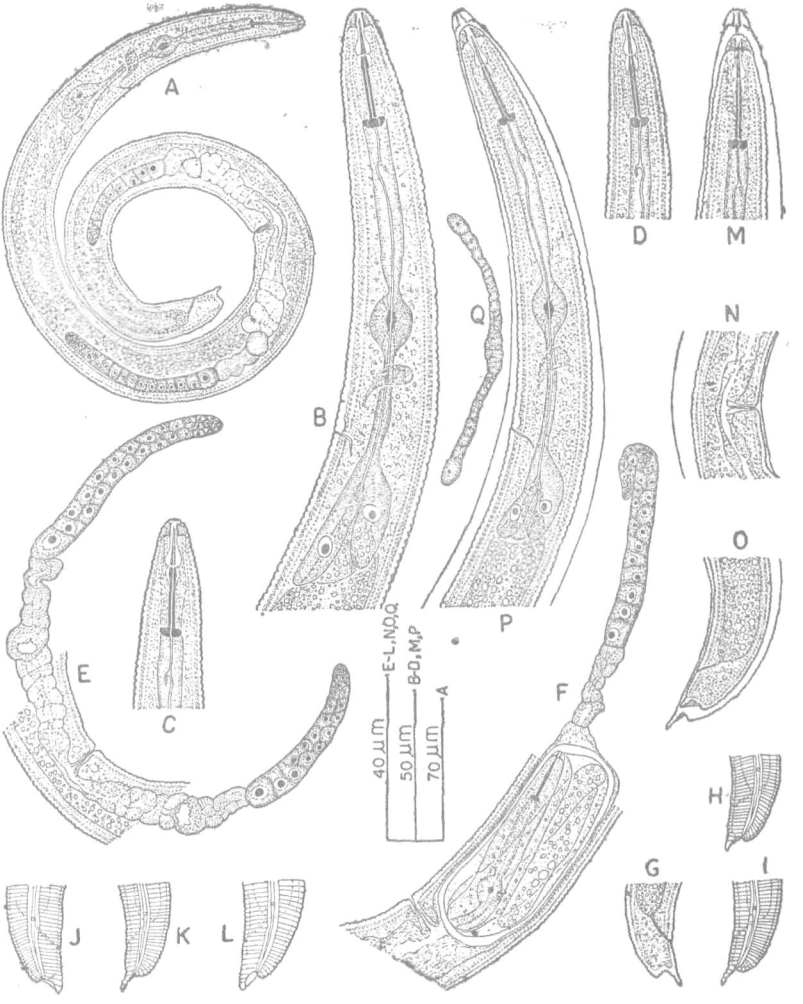

Fig. 4. *Helicotylenchus crenacauda* Sher, 1966 : A : Entire female ; B : Oesophageal region ; C & D : Anterior end ; E : Female reproductive system ; F : Anterior female reproductive system with reflexed ovary and an egg enclosing first stage juvenile ; G-L : Female tail ; M : Anterior end enclosed in fourth molt cuticle ; N : Vulva region enclosed in fourth molt cuticle ; O : Tail enclosed in fourth molt cuticle ; P & Q : Fourth stage juvenile ; P : Oesophageal region ; Q : Genital primordium.

Helicotylenchus crenacauda Sher, 1966

Syn. *Helicotylenchus pteracercus* Singh, 1971, new synonymy
H. indentatus Chaturvedi & Khera, 1979, new synonymy
?*H. parapteracercus* Sultan, 1981, new synonymy

(Figs 4 & 5)

Measurements : Table—III

Description :

Body spirally curved upon fixation Cuticle 1.5—2.0 μm thick, marked with distinct transverse striae. Lip region continuous, broadly rounded (80%) to trancated (20%), marked by 4—5 annules. Outer margins of labial framework extending posteriorly for 1—2 body annules. Anterior and posterior cephalids respectively 2—3 and 7—9 annules behind lip region. Lateral fields 1/7th—1/4th of body width near middle of the body. Hemizonid 0—2 annules from the excretory pore, 1.5—2.5 annules long. Stylet 3.6—4.3 times the head width. Stylet knobs flattened (30%) or indented (70%) anteriorly. Dorsal oesophageal gland opening 8.5—11.0 μm below the base of stylet. Vulva a transverse slit. Vagina about 1/2 of the corresponding body-width. Reproductive system outstreched except in one specimen where the anterior part of ovary is reflexed (Fig. 4, F). An egg enclosing first stage larva measures 78×28 μm. Oocytes arranged in one or two rows except in the multiplication area. Spermatheca well developed or less precise, without sperm. Rectum one half to almost one anal body-width long. Tail with a well developed ventral projection and the characteristic indentation at dorsal terminal part of the tail, marked by 6—12 annules ventrally. The inner pair of incisures fuse near the middle of tail and the ventral projection enveloped in cuticular fold originating from the terminal region of the lateral fields. The size of the cuticular fold-like structure depends upon the position of the specimen.

Morphometric and allometric characters : The various morphometric and allometric characters of adults *(female)* have been furnished in Table III. The position of median oesophageal bulb, excretory pore and vulva are significantly correlated with body length. The Coefficient of correlation are respectively R=0.900, 0.943 and 0.992. Fig. 5 shows relationship of body length with position of median bulb, excretory pore and vulva. The length of stylet (R=0.474), oesophagus (R=0.052), gonads (R=0.787) and tail (R=0.714) are not significantly correlated with the body length.

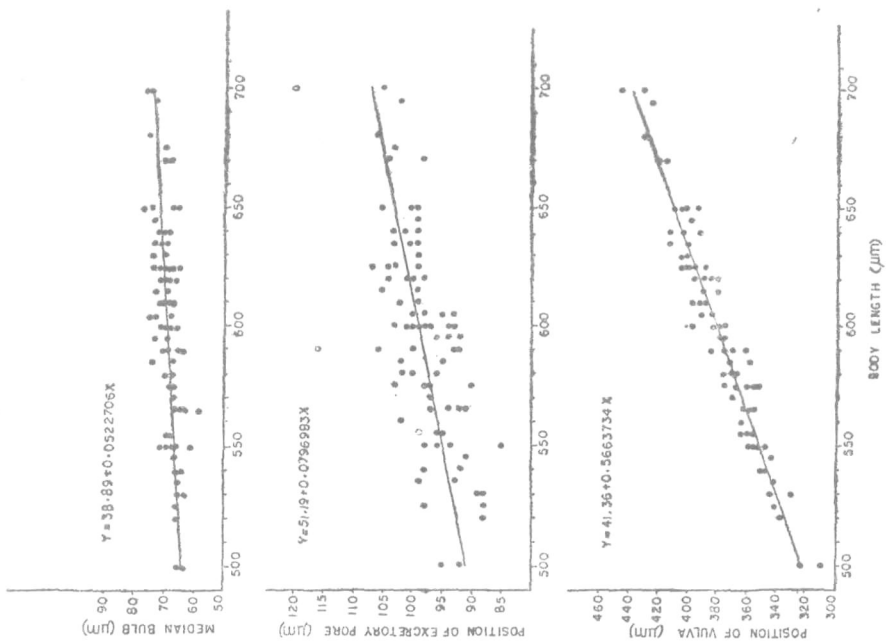

Fig. 5. *Helicotylenchus crenacauda* Sher, 1966 : Body length in relation to position of median bulb ; position of excretory pore and position of vulva.

Among all the morphometric and allometric characters analysed, the less variable characters (C.V.$\leqslant$3%) were the length of stylet, the value of V, and value of m. The characters which showed a high degree of variability (C.V.>10% were length of genital branches, vulval body-width, value of G_1 and G_2, value of c', tail annules, and the position of phasmids. The markedly variable characters (C V =7—10%) were length of body-width of lateral fields, position of median bulb, values of a and c, and length of tail. All the other characters were moderately variable (C.V. ranging from 4—6%).

The above observations on adult females of *Helicotylenchus crenacauda* show that the length of stylet and the value of V are least variable. These observations are in conformity with those of Bird & Mai (1967) on *Trichodorus christei* Allen, 1957 ; Azmi & Jairajpuri (1978) on *Helicotylenchus indicus* Siddiqi, 1963 ; Rashid & Khan (1978) on *Pratylenchus coffeae* (Zimmermann, 1898) Filipjev & S. Stekhoven, 1941 ; Baqri & Ahmad (1981) on *Tylenchorhynchus nudus* Allen, 1955 ; and others.

Juveniles :

First stage juvenile : Body enclosed in egg shell in three flexures (Fig. 4, F). Lip region and cuticle smooth. The outer wall of oesophagus and its inner cuticular lining incomplete. Median oesophageal bulb at 52 μm, measures 10×8 μm. Stylet measures 16 μm.

Fourth stage juveniles : (Fig. 4, P & Q) : No. 7. L (mm)=0.46 (0.44—0.47) SD=0.02 ; a=24 (22—25) SD=1.21 ; b=4.1 (4.2—4.8) SD=0.97 ; b'=3 8 (3.5—4.2) SD=0.23 ; c=24 (22—26) SD=1.51 ; c'=1.47 (1.4—1.5) SD=0.05 ; stylet (μm)=23 (22—24) SD = 0.75 ; m=47 (44—48) SD=1.57 ; O=36 (35—39) SD=4.22.

Discussion : *Helicotylenchus pteracercus* was described by Singh (1971) and was distinguished from *H. crenacauda* in having cuticular fold extending from the tip of the lateral fields to the terminus of tail projection and a more posteriorly situated phasmids (3 annules below to 2 annules above the level of the anus against 4—6 annules anterior to anus in *H. crenacauda*), a prominent and offset spermatheca but without sperm against inconspicuous spermatheca in *H. crenacauda*, somewhat shorter tail consisting more annules (c' = 0.60—1.08 and tail annules 10—15 against c'=1.0—1.3 and 5—10 tail annules in *H, crenacauda*.

As far as the cuticular fold in tail region is concerned, it is present in *H. crenacauda*. The other diagnostic characters have been found highly variable. The only character remains the posterior position of phasmids sometimes below the anus level. This can not be considered a character of diagnostic value of species level unless combined with other character because the position of phasmids has been found a highly variable character. *H. pteracercus* is proposed a synonym of *H. crenacauds*.

Chaturvedi & Khera (1979) described a new species *H. indentatus* from Burdwan, W. Bengal. The study of the paratypes of *H. indentatus* has revealed that some of the characters on which Chaturvedi & Khera (1979) separated their species from *H. crenacauda* were overlapping i. e. a=22-24 and c=33-41 against a=24-29 and c=33-52 in *H. crenacauda*. In addition, spermatheca with sperm and slopping stylet knobs against spermatheca without sperm and stylet knobs anteriorly indented in *H. crenacauda* were the other two distinguishing characters used by them. We have noted that spermatheca is always without sperm, the stylet knobs are either flattened or indented anteriorly. The report of Chaturvedi & Khera that all the four incisures appear passing round the tail tip could not be confirmed in the type specimens of *H. indentatus*. Three paratype females of *H. indentatus* were sent to Dr. P. A. A. Loof for comparison with paratypes of *H. crenacauda*. He agreed that both the species are identical in every respect including the fusion of inner incisures at tail tip. *H. indentatus* is here proposed as a new synonym of *H. crenaacuda*.

Sultan (1981) has described *H. parapteracercus* form Longthobol, Imphal, Manipur (India). He has distinguished this species from *H. crenacauda* and *H. pteracercus* in having more lip annules, longer stylet, anteriorly indented stylet knobs and different manner of termination of inner pair of incisures at tail tip. The other distinguishing characters used by him (value of O, ventral overlap of oesophageal gland lobe, position of phasmids and excretory pore) have been found variable characters in morphometric studies. Our present study reveals that *H. parapteracercus* also comes within the range of variations noted by us in *H. crenacauda* except the differently manner of fusion of inner incisures at tail tip, distinct and more number of lip annules. Since *H. pteracercus* has been considred a synonym of *H. crenacauda* and *H. parapteracercus* was described as an itermediate species, we feel that *H. parapteracercus* is probably a synonym of *H. crenacauda*. However, the described pattern of termination of inner two incisures at tail in the type specimens of *H. parapteracercus* tip and number of lip annules/need further confirmation. Unfortunately, the type specimens could not be traced.

SUMMARY

Helicotylenchus dihystera, H. multicinctus, H. erythrinae, H. retusus, H. microcephalus H. paraplatyurus, H. abunaami and *H. crenacauda* have been found in West Bengal (India) Each species is described and illustrated. The variability of *H. dihystera* (ten population) and *H. crenacauda* have been studied in more detail. *H. belurensis* is proposed as synonym of *H. microcephalus H. seshadrii* as synonym of *H. paraplatyurus. H. pteracercus, H. indentatus* and ? *H. parapteracercus* are proposed as synonym of *H. crenacauda.*

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TABLE—II

DIMENSIONS OF *HELICOTYLENCHUS DIHYSTERA*

Characters	Darjeeling population n=7 M±S. D. (Range)	Lebong population n=4 M±S.D. (Range)	Phoolsering population n=8 M±S D. (Range)	Kurseong population n=7 M±S. D. (Range)	Shaktigarh population n=10 M±S. D. (Range)	Dagapur Tea Estate population n=5 M±S. D. (Range)	Matigarh population n=3 M±S. D. (Range)	Collegepara population n=6 M±S. D. (Range)	Dakshing wrihati population n=4 M±S. D. (Range)	Dakshinkala Roy Population n=3 M±S. D. (Range)
L (mm)	0.57±0.05 (0.50-0.64)	0.62±0.02 (0.58-0.64)	0.64±0 53 (0.57-0.73)	0 57±0.04 (0.53-0.64)	0.61±0.04 (0.56-0.65)	0.60±0.03 (0.56-0.62)	0 62±0.04 (0.59-0.64)	0.55±0.36 (0.51-0.60)	0.56±0.02 (0.53-0 58)	0.55±0.03 (0.53-0.58)
a	23±1.34 (21-25)	22.5±0.58 (22-23)	24.0±1.98 (22-28)	23.0±1.70 (20-24)	24±2.12 (20-26)	21.0±0.44 (20-21)	22 0±1.00 (21-23)	26±1.79 (24-28)	22 0±0.15 (21-23)	22.0±0.57 (21-22)
b	4.8±0.35 (4.5-5.3)	5.1±0.27 (4.9-5.5)	5.2±0.44 (4.7-5.8)	5.0±0.30 (4.7-5.4)	5.3±0.22 (4.9-5.5)	5.2±0 28 (4.9-5.6)	5.2±0 20 (5.0-5.4)	5.0±0.35 (4 6-5.2)	5.1±0.51 (4.3-5.4)	5.1±0 32 (4.7-5.3)
b'	4.1±0.92 (3.7-4.4)	4.3±0.19 (4.1-4.5)	4.3±0.34 (3.9-4.8)	4.2±0 25 (3.8-4.4)	4.4±0.20 (4.1-4.6)	4.3±0.30 (3.9-4.7)	4.2±0 29 (4.1-4.6)	4 2±0.24 (3 9-4.4)	4.1±0.45 (4.0-4.5)	4.1±0.25 (3.9-4.3)
c	40±0.29 (34-50)	39±5.85 (34-46)	40±3.20 (34-44)	38±2.79 (33-41)	44±2.41 (39-47)	39±1.87 (38-40)	43±4.0 (39-47)	46±5.19 (37-51)	44±1.29 (42-45)	39±3.05 (36-42)
c'	1.15±0.05 (1.1-1.2)	1.03±0.15 (0.9-1 2)	1.03±0.12 (0.9-1 2)	1.04±0 07 (0 9-1.1)	1.01±0.09 (0.8-1.2)	0.86±0.05 (0.8-0.9)	0.96±0.15 (0.8-1.0)	0.95±0.12 (0.8-1.1)	0.88±0.05 (0.9-1.0)	1.0±0.10 (0.9-1.1)
V	63±1.25 (62-65)	65±2.51 (61-67)	64±2.53 (61-68)	64±1 95 (62-67)	64±2 35 (58-67)	63.8±0.44 (63-64)	65±1.15 (64-66)	65±1.87 (62-67)	64±2.06 (64-70)	63±1.15 (62-64)
G_1	20±1.57 (19-21)	24±2·98 (20·27)	23±2.76 (18-27)	23±0 95 (21-29)	25±2.90 (19-29)	24±1.09 (23-25)	28±1.73 (25-28)	27±2.59 (24-30)	27±1.50 (26-29)	28±3.79 (24-31)
G_2	19±4.46 (17-21)	21±1.71 (19-23)	21±1.83 (18-23)	19±0 97 (18-20)	21±2.01 (18-25)	24±1 22 (22-25)	20±1.52 (19-22)	21±1.21 (20-23)	23±0 (23)	23±3.46 (19-25)
m	47±1.06 (46-48)	47±1.0 (46-48)	47±0.99 (46-48)	47±0.97 (46-48)	47±1.41 (46-48)	47±2.89 (44-50)	48±0.00 (48)	48±0 99 (46-49)	47±2.13 (46-50)	47±1.15 (46-48)
o	45±6.61 (36-46)	37±2.0 (36-40)	38±3 51 (35-42)	37±1 06 (36-38)	42±3.09 (38-44)	37±1.54 (36-38)	36±1.52 (35-38)	37±1.40 (36-38)	39±1.15 (38.40)	39±4.24 (36-42)
Stylet (μm)	24.7±1.11 (23.0-25.5)	25 5±1.73 (24-28)	26.0±0 68 (25-27)	25.0±1.27 (22-26)	24.7±0 67 (24-26)	25±1.22 (23-26)	25±1.15 (24-26)	24.4±0.92 (23.0-25 5)	25±0.93 (24-26)	24±1.0 (23-25)
Conus (μm)	11.3±0.80 (11.0-11.5)	12.1±1.03 (11.0-13.5)	12.1±0.23 (12.0-12.5)	11.7±0.69 (10.5-12.5)	11.7±0.53 (11.0-12.5)	11.8±0.83 (11-13)	12.0±0.58 (11.5-12 5)	11.6±0 60 (11.0-11.5)	11.8±0.64 (11.0-12.5)	11.3±0.76 10.5-11.5)
Stylet knobs width (μm)	4.8±0.26 (4.5-5.0)	4.5±0.40 (4-5)	4.9±0.23 (4.5-5.0)	4.5±0 40 (4-5)	5.0±0.28 (4.5-5.5)	4 8±0 27 (4.5-5 0)	5.3±0.5 (5.0-5 5)	4.9±0.20 (4 5-5.0)	4.8±0.50 (4 5)	5±0 (5)
Median bulb (μm)	12.3±0.49 x 9±0.0 (12-13 x 9)	12.3±0 5 x 9.3±0.50 (12-13x9-10)	12 5±0 53 x 9.4±0.52 (12.13x9-10)	11.5±0.53 x 9.8±0.78 (11-12x8-10)	11 7±0.48 x 8.8±0.42 (11-12x8-9)	11 8±0.44 x 9.8±0.44 (11-12 x9-10)	11.6±1.15x 9.0±1.0 (12-13x8-10)	11.5±0.54 8.3±0.51 (11-12x8-9)	11.5±0.57 x 9.5±0.57 (11-12x9-10)	11.6±0.57 8 6±0.57 (11-12x8-9)
Nerve ring* (μm)	87±3.70 (83-94)	90±2.38 (88-92)	93±7.40 (80-103)	87±3 40 (83-93)	87±4 02 (81-91)	84±7 31 (73-90)	86±2.89 (84-89)	81±4.36 (76-87)	84±3.0 (81-87)	83±0.57 (82-83)
Excretory pore* (μm)	100±4.52 (96-109)	106±5.80 (100-113)	111±8 17 (99-123)	102±3.30 (99-108)	105±7.71 (93-116)	103±2 82 (99-105)	108±1.15 (107-109)	102±7.31 (93-115)	97±0.95 (96-98)	96±2 64 (94-99)
Tail length (μm)	14.5±1.27 (12-16)	16±1.82 (14-18)	16±1.39 (14-17)	16±1.57 (14-19)	14±1.05 (12-15)	14.6±2.60 (10-16)	14±1.73 (12-15)	13±1.94 (12-16)	12±1.70 (10-14)	14±1.52 (13-16)
Tail annules	12±1.39 (10-14)	13±0.95 (12-14)	13±0.93 (11-14)	13±1.38 (11-15)	12±1.26 (10-13)	10.8±1.30 (9-12)	11±4 16 (6-14)	10±1.26 (9-12)	9.3±0 50 (9-10)	11±1.0 (10-12)
Phasmids from anus (annules)	6.9±1.07 (6-9)	8.8±2.50 (6-12)	6.0±0.0 (6)	7.4±1.72 (6-9)	6.7±1.49 (6-9)	6.6±0 54 (7-8)	7.6±0.58 (6-8)	5.7±0.81 (5-6)	5.5±0.57 (6-8)	6.7±1.0 (6-7)

* Distances from anterior extremity.

TABLE—III

Morphometric and allometric variations in *Helicotylenchus crenacauda*

Characters	Range	Mean	S. D.	C. V
Length (um)	500-700	597	43.51	7.3%
a	20-29	24	2.38	9.9%
b	4 7.6.3	5.4	0.33	6.1%
b'	4 0-5.2	4.5	0.27	6.0%
c	30-44	38	3.57	9.4%
c'	0.9-1.4	1.1	0.13	12%
V	60-66	63	1.26	2.0%
G_1	19-33	26	3.38	13%
G_2	15-24	20	2.40	12%
m	44-50	47	1.41	3.0%
O	33-40	37	2.07	5.6%
Lateral fields (μm)	4-6	4.8	0 43	8.9%
Head height (μm)	3-4	3.8	0.26	6.9%
Head width (μm)	6-7	6.7	0.40	6.0%
Stylet (μm)	24-27.5	25.4	0.64	2.5%
Conus (μm)	11-13	11.8	0.52	4.4%
Stylet knobs width (μm)	4-5	4.9	0.27	5.6%
Dorsal oesophageal gland opening (μm)	8.5-11.5	9.4	0.52	5.5%
Oesophagus* (μm)	100-130	110	6.05	5.5%
Median oesophageal bulb* (μm)	58-76	69	5.45	7.9%
Median oesophageal bulb* length (μm)	12-14	12.6	0.66	5.2%
Median oesophageal bulb* width (μm)	8-11	9.6	0.66	6.9%
Nerve ring* (μm)	72-98	82	3.77	4.6%
Excretory pore* (μm)	85-120	99	5 64	5.7%
Vulva* (μm)	310-450	380	26.22	6.9%
Anterior gonad length (μm)	105-208	152	19.76	13%
Posterior gonad length (μm)	98-164	121	15.73	13%
Vagina length (μm)	10-15	11.6	1.28	11%
Body width at vulva (μm)	20-29	25	3.00	12%
Anal body diameter (μm)	12-17	14	1.11	7.9%
Rectum length (μm)	9-13	10	0.97	9.7%
Tail length (μm)	13-19	16	1.55	9.7%
Tail annules (Ventrally)	6-12	9	1.62	18%
Phasmids from anus (annules)	6-17	9.6	2.02	21%

* Distance from anterior extermity.

Caffraria', i.e. near Durban, Natal. It therefore seems perfectly justifiable to set aside the type locality designated by Thomas. The neotype proposed by Olson is from a definite locality which is both within the range of the recognisably distinct southern subspecies and near enough to where Sundevall's specimen originated. It would fulfil the purpose of stabilising the nomenclature of the species. I therefore support both of Dr Olson's proposals.

COMMENT ON THE PROPOSED DESIGNATION OF A TYPE SPECIES FOR *INDODORYLAIMUS* ALI & PRABHA, 1974 (NEMATODA, DORYLAIMIDA) Z.N.(S.) 2335

(see vol. 39, pp. 57–58; vol. 39, p. 285)

(1) By M. R. Siddiqi (*Commonwealth Institute of Parasitology, Herts, U.K.*)

The application of Qaiser Baqri as published in *Bull. zool. Nom.* vol. 39, p. 285, states that he has designated a lectotype from the available syntypes, and I feel that the use of plenary powers to support this action is not called for. Article 74a of the International Code clearly provides for such an action of designating a syntype as lectotype and Baqri's action is justified.

With regard to the proposal to designate a type species for *Indodorylaimus* Ali & Prabha, 1974 (*Bull. zool. Nom.* vol. 39, pp. 57–58), I strongly believe that *Thornenema wickeni* Yeates, 1970, a well documented species, is the type species of the genus *Indodorylaimus* Ali & Prabha, 1974, for the following three reasons:

1. *Indodorylaimus* n.gen. was proposed by Ali & Prabha, 1974 (*Nematologica* vol. 19, for 1973, p. 486) who fixed its type species thus:

Type species: *Indodorylaimus wickeni* (Yeates, 1970)

n.comb. (syn. *Thornenema wickeni* Yeates, 1970). *Thornenema wickeni* Yeates, 1970 is thus the original designation of the type species for *Indodorylaimus*, and is the type species regardless of other considerations (Art. 68a).

2. The reason for the creation of a new genus *Indodorylaimus* is given by the authors just before the generic diagnosis as follows:

'Yeates (1970) described *Thornenema wickeni* based on females. The female specimens described herein agree with his description in all essential measurements and in body characters. However the males of this species, reported herein for the first time, have a tail similar to that of the female necessitating removal of this species from *Thornenema* in which the tails of the sexes are dissimilar (elongate-filiform in females and short, bluntly conoid in males). Therefore a new genus *Indodorylaimus* is proposed for its inclusion under Prodorylaimidae.'

This clearly shows that the authors discussed the taxonomy of *Thornenema wickeni* Yeates and proposed a genus for its reception. (Note 'its inclusion' in the last sentence).

3. Ali & Prabha (1974) differentiated their new genus *Indodorylaimus* thus:

'*Indodorylaimus* is close to *Sicaguttur* from which it differs in having a mono-opisthodelphic gonad in the female and the first ventromedian supplement within the range of spicules in the male.'

Please note that the female characteristic is used first for the differentiation. *T. wickeni* is based on females only, and Ali & Prabha (1974) added male characteristics in the generic diagnosis of *Indodorylaimus* because they thought that their species with males was *T. wickeni*.

The genus *Indodorylaimus* may, or may not, be a valid genus, but another species viz. *Indodorylaimus elongatus* Baqri, 1982 (= *Indodorylaimus wickeni* apud Ali & Prabha, 1974) could not and should not be designated as the type species of *Indodorylaimus* Ali & Prabha, as discussed above.

(2) By Dr Q. H. Baqri (*Zoological Survey of India, Calcutta, 700016, India*)

In reply to the above comment by M. R. Siddiqi, nowhere in my application have I stated that the generic diagnosis of *Indodorylaimus* Ali & Prabha, 1974 is inadequate or that the description provided by the authors is poor. Rather, I have clearly stated that the type specimens of *Thornenema wickeni* Yeates, 1970 were compared with Ali & Prabha's specimens and the latter were found different in many characters. Hence, the specimens on which *Indodorylaimus* Ali & Prabha, 1974 was based were misidentified.

The species that was before Ali & Prabha had no valid name and was found to be a new species. In the circumstances (Article 49), I named the species *Indodorylaimus elongatus* Baqri, 1982 (= *T. wickeni* apud Ali & Prabha, 1974) and designated it as type species of *Indodorylaimus*. Article 72d has the provision that if an author proposes a new specific name expressly as a replacement for a prior name, it retains the type of the taxon bearing the prior name. Hence, Ali & Prabha's specimens were retained as types with the replaced name.

Articles 41, 49, 65b, 67j, and 70a deal with the misidentification of type species. Mayer, E. in his *Principles of Systematic Zoology*, p. 370, states that the principle on which such corrections (misidentification of types) are based is that the type of a taxon is not a name but the zoological object. The type (species or genus) is then the zoological object which the original author had before him (when making the type designation) *and* not the name which he may have erroneously attached to this object.

In light of the above, I find it rather difficult to accept the objection raised by Dr Siddiqi. To me it seems that Article 68a of the International Code is not applicable under the circumstances.

PROPOSAL TO EMEND Z.N.(S.) 2401 BY DESIGNATING *IPIS PILIPES* AS TYPE SPECIES OF *MEGILLA* FABRICIUS

By Charles D. Michener (*Department of Entomology, University of Kansas, Lawrence, Kansas 66045, U.S.A.*)

One aspect of a recent proposal (Michener, 1983) urged suppression of the first designation of a type species of the genus *Megilla* Fabricius, 1805. This action would validate the designation of *Ipis maculata* Linnaeus, 1758, as the type species of *Megilla* by Richards, 1935. My proposal was made with the objective of placing *Megilla* as a junior synonym of *Anthophora* Latreille, 1803.

Bull. zool. Nom., vol. 43, pt 3, October 1986

OPINION 1404
INDODORYLAIMUS ELONGATUS BAQRI, 1982 DESIGNATED AS TYPE SPECIES OF *INDODORYLAIMUS* ALI & PRABHA, 1974 (NEMATODA, DORYLAIMIDA)

Ruling.—(1) Under the plenary powers all type designations for the nominal genus *Indodorylaimus* Ali & Prabha, 1974 are set aside and *Indodorylaimus elongatus* Baqri, 1982 is designated as type species.

(2) The name *Indodorylaimus* Ali & Prabha, 1974 (gender: masculine), type species by designation under the plenary powers in (1) above, *Indodorylaimus elongatus* Baqri, 1982, is hereby placed on the Official List of Generic Names in Zoology.

(3) The name *elongatus* Baqri, 1982, as published in the binomen *Indodorylaimus elongatus* (specific name of the type species of *Indodorylaimus* Ali & Prabha, 1974) is hereby placed on the Official List of Specific Names in Zoology.

HISTORY OF THE CASE Z.N.(S.)2335

An application for the designation of *Indodorylaimus elongatus* Baqri, 1982 as type species of *Indodorylaimus* Ali & Prabha, 1974 was first received from Dr Q. H. Baqri (*Zoological Survey of India, Calcutta*) on 19 February 1980. After correspondence a revised draft was published in *Bull. zool. Nom.*, vol. 39, pp. 57–58 (March 1982). Additional information concerning a lectotype designation for *Indodorylaimus elongatus* Baqri, 1982 was received and published in vol. 39, p. 285. Public notice of the possible use of the plenary powers in the case was given in the same part of the *Bulletin* as well as being sent to nine general and seven specialist serials. A comment from Dr Siddiqui (*Commonwealth Institute of Parasitology, U.K.*) was received and published with a reply from Dr Baqri in *Bull. zool. Nom.*, vol. 41, pp. 137–138.

DECISION OF THE COMMISSION

On 17 April 1986 the members of the Commission were invited to vote under the Three-Month Rule for or against the proposals set out in *Bull. zool. Nom.*, vol. 39, pp. 57–58. At the close of the voting period on 17 July 1986 the state of the voting was:

Affirmative Votes—seventeen (17) received in the following order: Melville, Savage, Cocks, Kabata, Mroczkowski, Corliss, Starobogatov, Schuster, Halvorsen, Hahn, Ueno, Thompson, Alvarado, Ride, Bayer, Kraus, Cogger

Negative Votes—three (3) received in the following order: Holthuis, Willink, Kraus.

No votes were returned by Bernardi, Dupuis, Heppell, Lehtinen and Trjapitzin. Gruchy was on leave of absence.

ORIGINAL REFERENCES

The following are the original references to the names placed on Official Lists by the ruling in the present Opinion:
elongatus, Indodorylaimus, Baqri, 1982, *Bull. zool. Nom.*, vol. 39, p. 57
Indodorylaimus Ali & Prabha, 1974, *Nematologica*, vol. 19, p. 486.

CERTIFICATE

I hereby certify that the votes cast on Voting Paper (1986) 21 were cast as set out above, that the proposals contained in that voting paper have been duly adopted under the plenary powers, and that the decision so taken, being the decision of the International Commission on Zoological Nomenclature, is truly recorded in the present Opinion No. 1404.

P. K. TUBBS
Executive Secretary
International Commission on Zoological Nomenclature
London
18 July 1986

Bull. Zool. Surv. India, 6 (1-3) : 75-79, 1984

NEMATODES FROM WEST BENGAL (INDIA) XIV. ON THE OCCURRENCE OF ECTOPARASITIC NEMATODES OF LONGIDOROIDEA AND TRICHODOROIDEA (DORYLAIMIDA), WITH REMARKS ON THE VALIDITY OF GENUS *SIDDIQIA* (LONGIDORIDAE)

A. JANA AND Q. H. BAQRI
Zoological Survey of India, Calcutta

ABSTRACT

The male of *Paralongidorus citri* (Siddiqi, 1959) Siddiqi, Hooper and Khan, 1963 is reported for the first time. *Longidoroides droseri* (Sukul, 1971) Khan, Chawla and Saha, 1978 is being synonymised with *P. citri*. The genus *Siddiqia* Khan, Chawla and Saha, 1978 is considered a synonym of *Paralongidorus* Siddiqi, Hooper and Khan, 1963. *Paratrichodorus* (*Atlantodorus*) *porosus* (Allen, 1957) Siddiqi, 1974 and *P.* (*Nanidorus*) *renifer* Siddiqi, 1974 are reported from soil around roots of tea at Darjeeling.

INTRODUCTION

Our knowledge about the occurrence of longidorid and trichodorid nematodes in West Bengal is very meagre despite their economic importance as ectoparasites of plants and most of them as vectors of viruses. Sukul (1971) described *Paralongidorus droseri* from Birbhum district. Chaturvedi and Khera (1979) have reported *Xiphinema americanum* Cobb, 1913 and *X. insigne* Loos, 1949 from Howrah and Hooghly districts respectively.

Jana and Baqri (1977) have already reported the following species from Darjeeling and Jalpaiguri districts of West Bengal : *Xiphinema radicicola* Goodey, 1936 ; *X. brasiliense* Lordello, 1951 ; *X. insigne* Loos, 1949 ; *X. reversi* Dalmasso, 1969 ; and *Paralongidorus citri* (Siddiqi, 1959) Siddiqi, Hooper and Khan, 1963. Further investigations have yielded a male of *Paralongidorus citri* for the first time which is described and illustrated herein. Besides, a soil sample collected from around roots of tea at Darjeeling contained the following two species of the genus *Paratrichodorus* Siddiqi, 1974 : *P.* (*Atlantodorus*) *porosus* (Allen, 1957) Siddiqi 1974 and *P.* (*Nanidorus*) *renifer* Siddiqi, 1974. This is the first record of the genus *Paratrichodorus* from West Bengal.

The study of the topotype females of *Paralongidorus droseri* Sukul, 1971 (=now *Longidoroides droseri*) has revealed that it is a synonym of *P. citri*. The present paper also concludes that the genus *Siddiqia* is a synonym of *Paralongidorus*.

Paralongidorus citri (Siddiqi, 1959)
Siddiqi, Hooper and Khan, 1963
(Fig. 1, A-G)

Syn. *Xiphinema citri* Siddiqi, 1959, *Proc. helminth. Soc. Wash.*, **26** : 160-162.

Siddiqia citri (Siddiqi, 1959) Khan, Chawla and Saha, 1978, *Indian J. Nematol.*, **6** : 57.

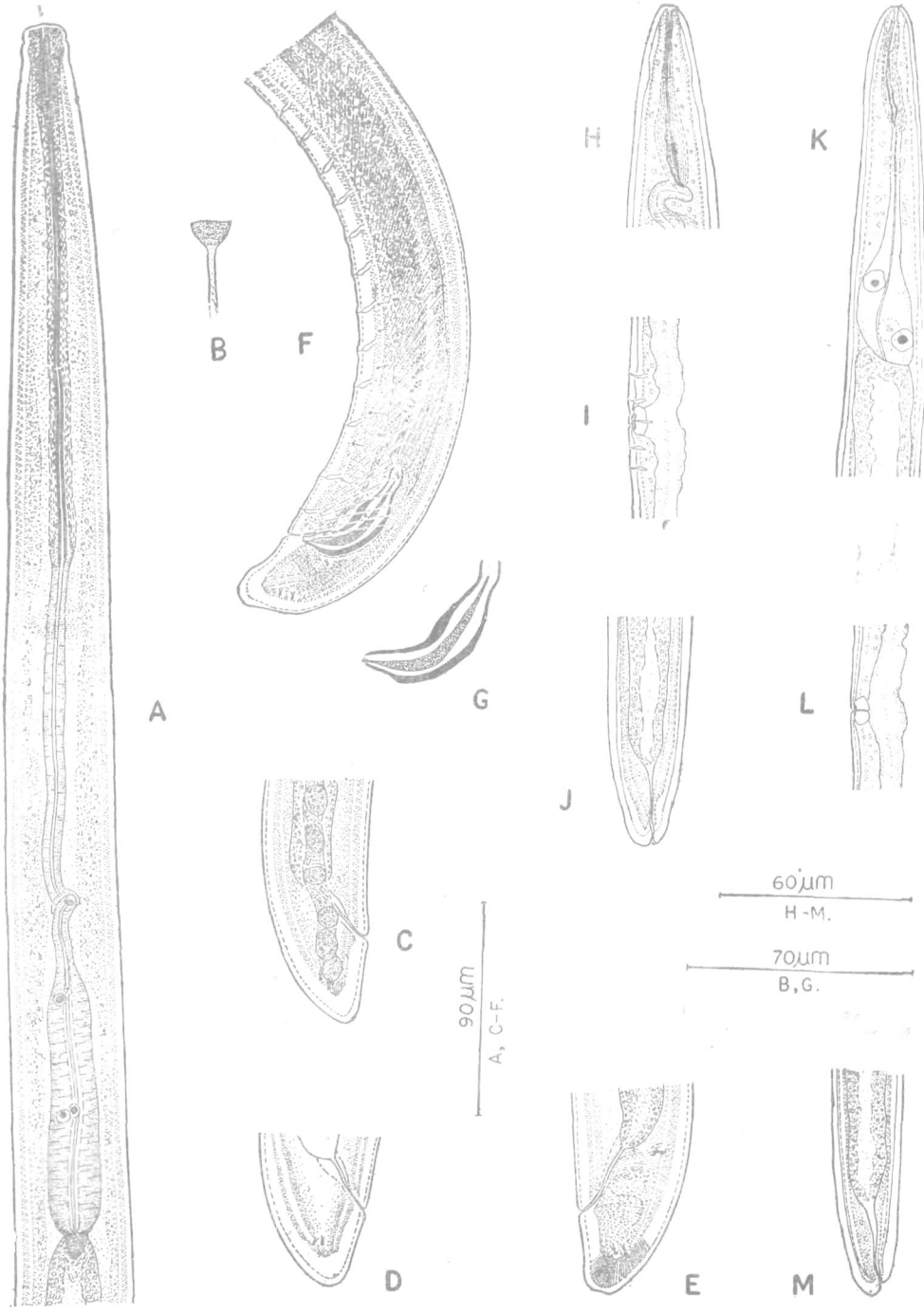

Fig. 1. A-G. *Paralongidorus citri*, A-Oesophageal region, B-Amphid, C-E, Female tails showing variation, F-Posterior region of male, G-Spicule. H-J. *Paratrichodorus* (*Atlantodorus*) *porosus*, H-Anterior end, I-Vulva region, J-Female tail. K-M. *Paratrichodorus* (*Nanidorus*) *renifer*, K-Anterior region, L-Vulva region, M-Female tail.

Paralongidorus droseri Sukul, 1971, *Bull. Ent.*, **12** : 85-88.

Longidoroides droseri (Sukul, 1971) Khan, Chawla and Saha, 1978, *Indian J. Nematol.*, **6** : 52, new synonymy.

Measurements :

Females (10) : L=6.30–8.66 mm ; a=99–152 ; b=10.3–15.8 ; c=184–238 ; v=$^{4-5}$42–46$^{4-6}$; odontostyle=126–141 μm ; odontophore=74–90 μm.

Male (1) : L=6.71 mm ; a=129 ; b=13.2 ; c=197 ; T=42 ; odontostyle=139 μm ; odontophore=79 μm.

Description :

Female : Body ventrally arcuate upon fixation. Cuticle finely striated transversely, 3-13 μm thick (thickest on tail). Lateral chords 1/6th-1/4th of the body-width near middle. Lip region broadly rounded demarcated by a constriction. Amphids stirrup-shaped with a wide slit-like apertures, occupying 75% of the corresponding body-width ; amphidial basal lining not lobed. Odontostyle 7.6-8.2 lip region-width long. Guiding ring 1.8-2.1 lip region-width from anterior end. Odontophore 0.6-0.7 times the odontostyle length. Basal expanded part of oesophagus occupies 21-26% of the neck region. Vulva transverse ; vagina extending inward about half of the corresponding bodywidth. Female reproductive system amphidelphic. Prerectum 15-18 times the anal body-width. Tail convex—conoid with obtusely rounded or rounded terminus, 34-39 μm or 0.8-1.1 anal body-width long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except the male reproductive system and more ventrally curved posterior region. Supplements consist of an adanal pair and 11 ventromedians, spaced nearly at regular intervals, the first ventromedian supplement at about 0.8 anal body-width from cloacal opening. Six irregularly spaced subventral papillae visible up to fifth ventromedian supplement. Spicules 60 μm or 1.7 anal body-width long when measured along the curved median line. Lateral guiding pieces rod-shaped, 14 μm long. Prerectum 662 μm or about 19 anal body-width long. Tail almost similar to female, 34 μm or about one anal body-width long, with three caudal pores on each side.

Habitat and locality : Soil around roots of mango, *Mangifera indica* and Banana, *Musa* sp. at New Jalpaiguri, district Jalpaiguri.

DISCUSSION

Sukul (1971) described a new species *Paralongidorus droseri* and distinguished it from the *P. citri* on the following differences : Shorter and differently shaped tail and longer body length. Khan *et al.*, (1978) proposed a genus *Longidoroides* under Longidoridae to accommodate the species of *Longidorus* and *Paralongidorus* having large amphids, pouch-like, slit-like apertures, with unlobed or bilobed basal lining. They also transferred *Paralongidorus droseri* under their newly proposed genus. The study of the topotype specimens of *P. droseri* obtained through the courtesy of Dr. N. C. Sukul has confirmed that he (1971) has correctly illustrated the structure of the amphids as stirrup-shaped and it is not pouch-like. The study finally reveals that these specimens belong to *Paralongidorus* and all the differentiating characters of *P. droseri* from *P. citri*, mentioned by Sukul (l. c.), are overlapping with the original description and measurements of the latter

(L=6.53-6.81 mm in *P. droseri* aganist 6.73-7.44 mm in *P. citri* ; c=178-181 in *P. droseri* against 181-197 in *P. citri* ; tail dorsally covex-conoid with a rounded terminus in *P. droseri* against dorsally-convex-conoid with obtusely rounded terminus in *P. citri*). Hence, *P. droseri* is hereby considered a synonym of *P. citri*. The variation in the tail terminus from obtusely rounded to rounded in the present population from New Jalpaiguri further supports our view.

REMARKS

Khan, Chawla and Saha (1978) have proposed a genus *Siddiqia* to accommodate those species of the genus *Paralongidorus* having lip region with distinct constriction at the level of amphidial apertures, sometimes with a second depression further back. They have assigned *P. citri* (Siddiqi, 1959) as type species of the genus. However, the genus *Siddiqia* has not been recognized by the present authors because the slight depression in the lip region cannot be accepted as a generic character unless this is combined with other characters. Since this depression in the lip region has no phylogenetic importance and this minute character is not supported by other characters, *P. citri* (Siddiqi, 1959) Siddiqi, Hooper and Khan, 1963 and other species of *Paralongidorus* transferred to *Siddiqia* by Khan *et al.* (1978) are reverted to the genus *Paralongidorus*. Moreover, the acceptance of the genus *Siddiqia* will encourage further inflation of the genera in dorylaims which shall create much confusion in the group.

The following recently described species under *Siddiqia* are also transferred to *Paralongidorus* :

Paralongidorus mediensis
(Ganguly, Patil and Khan, 1980) N. Comb.

Syn. *Siddiqia mediensis* Ganguly, Patil and Khan, 1980, *Indian J. Nematol.*, **10** : 175-178.

Paralongidorus dasturi (Ganguly, Patil and Khan, 1980) N. Comb.

Syn. *Siddiqia dasturi* Ganguly, Patil and Khan, 1980, *Indian J. Nematol.*, **10** : 178-181.

Paralongidorus inagreina (Chawla and Samathanam, 1980) N. Comb.

Syn. *Siddiqia inagreina* Chawla and Samathanam, 1980, *Indian J. Nematol.*, **10** : 205-207.

Paralongidorus seclipsi (Khan, Singh and Singh, 1980) N. Comb.

Syn. *Siddiqia seclipsi* Khan, Singh and Singh, 1980, *Indian J. Nematol.*, **10** : 211-213.

Paratrichodorus (Atlantodorus) porosus
(Allen, 1957) Siddiqi, 1974
(Fig. 1, H-J)

Syn. *Trichodorus porosus* Allen, 1957, *Nematologica*, **2** : 40-42.

Females (9) : L=0.44–0.52 mm ; a=15–18 ; b=4.2–5.1 ; c=sub-terminal ; v=$^{20-24}_{19-25}$; $^{53-56}$ onchiostyle=46–53 μm.

Description :

Female : Body almost straight upon fixation. Cuticle finely striated. Lip region marked off by a very slight depression. Lateral, ventral and dorsal body pores absent except two pairs of ventromedian pores near vulva (one pair on each side of vulva as shown in Fig. 1, I). Onchiostyle slender, 46–53 μm long ; anterior tip 24–28 μm long ; its guiding ring at 19–22 μm from anterior end. Basal expanded part of oesophagus pyriform. Intestine slightly overlapping the posterior end of oesophagus. Vulva a transverse slit ;

vagina 5–7 μm long with two sclerotized pieces at distal end. Female reproductive system amphidelphic. Anus subterminal.

Male : Not found.

Habitat and locality : Soil around roots of tea, *Thea sinensis* at Lebong Tea Estate, Lebong, district Darjeeling.

Paratrichodorus (Nanidorus) renifer Siddiqi, 1974

(Fig. 1, K-M)

Syn. *Paratrichodorus (Nanidorus) renifer* Siddiqi, 1974, *Nematologica*, **19** : 275-277.

Measurements :

Females (8) : L=0.48–0.59 mm ; a=19–21 ; b=4.6–6.1 ; c=subterminal ; v=$\frac{14-19}{54-57}$ $\frac{16-19}{}$; onchiostyle=29–33 μm.

Description :

Female : Body almost straight upon fixation. Cuticle smooth. Dorsal, ventral, lateral and caudal pores not visible. Lip region continuous. Onchiostyle 29–33 μm ; anterior tip 12–14 μm ; its guiding ring at 12–14 μm from anterior end. Basal expanded part of oesophagus pyriform, its base somewhat flattened. Vulva inconspicuous ; two small dot-like sclerotized pieces present at vulva-vagina junction. Female reproductive system amphidelphic. Anus subterminal.

Habitat and locality : Soil around roots of tea, *Thea sinensis* at Lebong Tea Estate, Lebong, district Darjeeling.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. B. K. Tikader, Director of the Zoological Survey of India, Calcutta for providing research facilities. Thanks are also due to Dr. N. C. Sukul, Reader in Zoology, Visva Bharati, Santiniketan, West Bengal for arranging the topotype specimens of *P. droseri* for the present study.

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Indian J. Nematol. 15(1), 1985, 124

On the identity of *Indokochinema ekramullahi Jana & Baqri*, 1983

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Jana & Baqri (1983) described three new species of dorylaims from West Bengal and one of these was *Indokochinema ekramullahi*, the second species of the genus.

Comparison of these specimens with the specimens of *Ecumenicus monohystera* (de Man, 1880) Thorne, 1974 revealed their conspecificity. Hence, *I. ekramullahi* Jana & Baqri, 1983 becomes a junior synonym of *E. monohystera*.

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NEMATODES FROM WEST BENGAL (INDIA)
XVII. A NEW SPECIES OF THE GENUS *PRODORYLAIMUS* ANDRA'SSY, 1959 (DORYLAIMIDAE : DORYLAIMIDA)

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ABSTRACT

A new species of the genus *Prodorylaimus* Andrássy, 1959 is described from Santiniketan, district Birbhum, West Bengal. *Prodorylaimus sukuli* sp. n. is characterized by having L=2.42-2.66 mm ; a=30-40 ; b=4.2-4.9 ; c=7.5-11 ; V=44-47 ; odontostyle=30-33 μm ; odontophore=28-33 μm.

INTRODUCTION

Two slides containing the nematodes were brought by the first author to Zoological Survey of India for identification. Upon identification, these nematodes were found to represent a new species of the genus *Prodorylaimus* Andrássy, 1959 which is described hereunder as *P. sukuli*.

MATERIAL

Three type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta. *P. Sukuli* ; Holotype female along with one paratype female and one paratype male on slide No. WN 495. The other paratypes have been deposited with the museum of Zoology Department. Visvabharti University, Santiniketan, W. Bengal.

Prodorylaims sukuli* sp. n.

(Fig. 1)

Measurements :

Holotype (♀) : L=2.65 mm ; a=37 ; b=4.5 ; c=7.5 ; $V=^{14}45^{14.5}$.

Paratypes : 3 ♀♀ : L=2.46-2.66 mm ; a=30-37 ; b=4.2-4.6 ; c=7.9-11 ; $V=^{14\text{-}15.5}44\text{-}47^{14.6\text{-}16.6}$.

Paratypes : 3♂♂ : L=2.42-2.51 mm ; a=34-40 ; b=4.2-4.9 ; c=8.6-8.8 ; T=49-55.

* Named after Dr. N. C. Sukul, Reader in Zoology, Visva Bharati University, Santiniketan.

Description :

Female : Body slightly curved ventrally upon fixation, tapering towards both extremities. Cuticle finely striated transversely ; its thickness varies 2.5-5.5 μm (thickest on tail). Lateral chords granular, 1/5-1/4 of body-width near middle. Dorsal, ventral and latetal body pores indistinct.

Lip region rounded, narrower than body, marked by a slight depression, about 1/6.0-1/

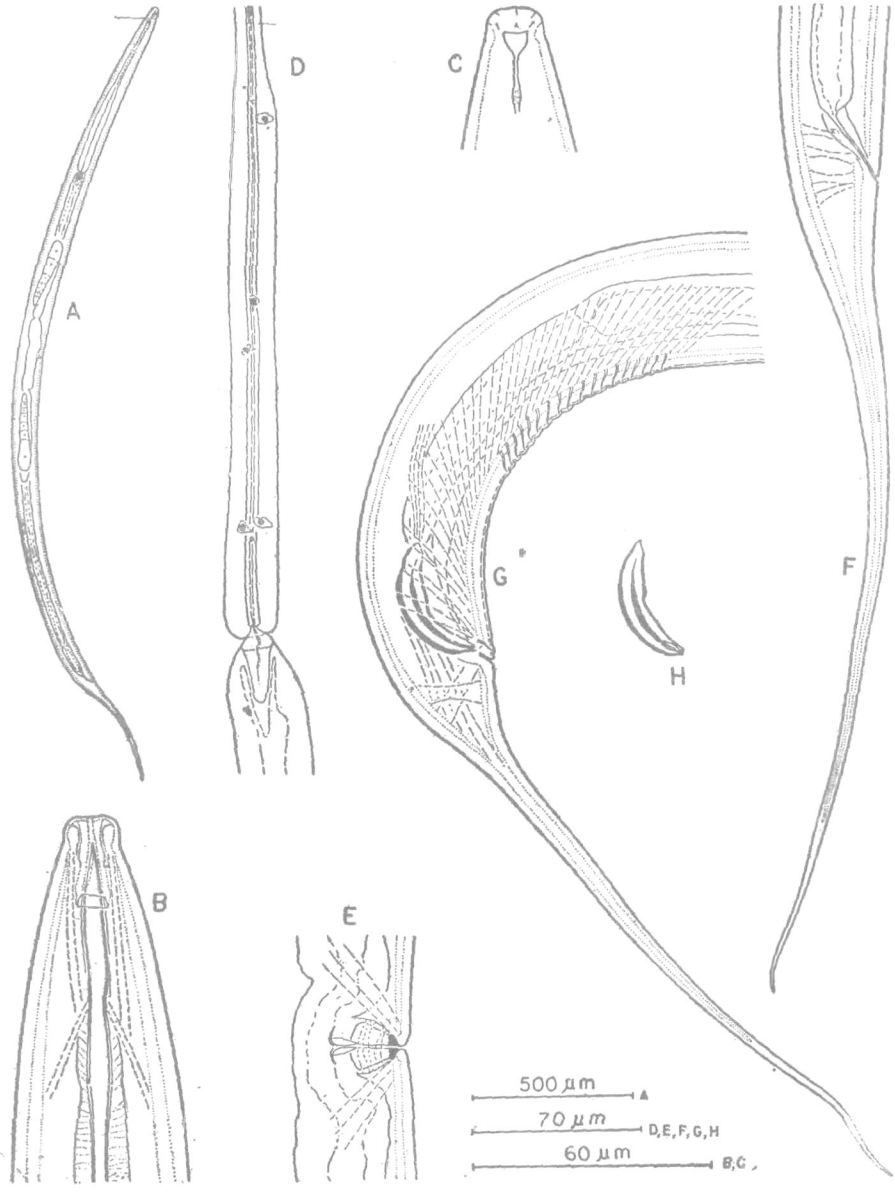

Fig. 1. *Prodorylaimus sukuli* sp. n. : A—Entire female, B—Anterior region, C—Head end (superficial view), D—Basal expanded part of oesophagus showing oesophageal gland nuclei and their orifices, E—Vulva region, F—Female tail, G—Male posterior region, H—Spicule

4.5 of the body-width at base of oesophagous. Amphids stirrup-shaped ; their apertures 6.5-8.0 μm or 47-55% of the corresponding body-width, and 6-7 μm from anterior end. Sensillar pouches 17-19 μm from amphidial slits.

Obontostyle 30-33 μm or 2.1-2.3 head-width long ; aperture 11-12 μm or 37-40% of the odontostyle length. Guiding ring 19-21 μm or 1.3-1.5 head-width from anterior end. Odontophore simple, 28-33 μm or 0.9-1.1 times the odontostyle length. Basal expanded part of oesophagus occupying 46-53% of the neck region. Position of the oesophageal gland nuclei and their orifices as follows (observed only in one female) : DO = 55.1 ; DN = 58.9 ; DO-DN = 3.8 ; $S_1 N_1 = 77$; $S_1 N_2 = 80$; $S_2N = 91$; $S_2O = 92$. Nerve ring 133-166 μm or 23-29% of the neck region from anterior end. Cardia elongate-conoid, enveloped in intestinal tissue. Oesophago-intestinal disc present. Prerectum 86-128 μm or 2.3-3.3 anal body-width long. Rectum 27-33 μm or 1.2 anal body-width long.

Vulva a transverse slit. Vagina more than 1/3rd of corresponding body-width long, sclerotized distally. Female reproductive system amphidelphic. Uteri smaller than oviducts, separated by sphincter. Ovaries reflexed ; oocytes arranged in a single row except in the region of multiplication.

Tail long, 230-354 μm or 6-9 anal body-width long. Caudal pores indistinct.

Male : Similar to female in general shape and morphology except for the male reproductive system and more ventrally curved posterior part of the body. Prerectum short, 100-135 μm or 2.5-3.2 anal body-width long. Tail long, 280-290 μm or about 7 anal body-width long. One male was found with broken tail tip (mounted along with holotype female), 150 μm or about 3.5 anal body-width long.

Reproductive system typical. Spicules 57-67 μm or 1.3-1.6 anal body-width long. Lateral guiding pieces 9-11 μm long. Supplements an adanal and 17-18 contiguous ventromedians. Copulatory muscles 39-41.

Differential diagnosis : *Prodorylaimus sukuli* sp. n. comes close to *P. dahli* (Altherr, 1960) Andrássy, 1964 and *P. paralongicaudatus* (Micoletzky, 1925) Andrássy, 1959. From the former it differs in having differently shaped lip region, thicker body (a = 47-64 in *P. dahli*), more posterior vulva (V = 35-41 in *P. dahli*), longer odontostyle in relation to head-width (odontostyle less than 1.9 head-width in *P. dahli*), shorter odontostyle aperture and odontophore (odontostyle aperture = 15–16 μm and odontophore = 28-33 μm in *P. dahli*). From *P. paralongicaudatus* the present new species differs in having shorter odontostyle, odontostyle aperture, odontophore and tail (odontostyle = 38-39 μm, odontostyle aperture = 14-16 μm, odontophore = 42–45 μm and tail more than 20 anal body-width long in *P. paralongicaudatus*). From *P. dahli* and *P. paralongicaudatus* it can further be differentiated in the absence of distinct body pores and post-odontophore constriction.

Type habitat and locality : Collected from soil around roots of an insectivorous plant, *Drosera burmani* at the gullies of the bad land,

Santiniketan, district Birbhum, W. Bengal, India.

ACKNOWLEDGEMENTS

We are grateful to Dr. B. K. Tikader, Director of Zoological Survey of India, Calcutta and the Head of the Zoology Department, Visva Bharati University, Santiniketan for providing research facilities. We are also thankful to Dr. N. C. Sukul, Reader in Zoology Department, Visvabharti University for allowing us to publish the description of the present new species.

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STUDIES ON THE NEMATODES FROM MANGROVE SWAMPS OF DELTAIC SUNDARBANS, WEST BENGAL. (I) *INDODITYLENCHUS SUNDARBANENSIS* N.GEN. N.SP. TYLENCHIDAE: TYLENCHIDA)

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**Department of Marine Science, Calcutta University, Calcutta.*

INTERODUCTION

Analysis of detritus rich mangrove litter soil around roots of *Avicennia officinalis* at Prentice Island, a virgin mangrove field of deltaic sundarbands, revealed five female members of a tylnechid nematode. A meticulous examination revealed their proximation to the family Tylenchidae but the conspicuous absence of lateral field incisures and the unusual location of excretory pore anterior to the median bulb tended the authors to put it under a new genus *Indoditylenchus*. The present specimens appeared to be very close to the genus *Ditylenchus*, Filipjev, 1936 and *Sychnotylenchus* Rhum, 1956.

MATERIAL AND METHOD

The specimens were collected by the first author in February 1984, killed and fixed in hot 4% formalin and mounted in dehydrated glycerine. Holotype mounted on slide WN518 and paratypes on slides WN519 & WN520; deposited with the National Collection of Zoological survey of India, Calcutta.

INDODITYLENCHUS N. GEN.

Diagnosis: Tylenchoidea. Body 0.76–1.00 mm long, cuticle nonannulated, marked with fine striations like dorylaimids; lateral

fields without incisures; lip region smooth, continuous with the body, head sclerotization weak; median bulb at 42-45% of the oesophageal length *from anterior* end: excretory pore anteroir to the median bulb, 4.5-5.5% of the oesophageal length from anteroir end; oesophagous does not overlap intestine; female reproductive system mono-prodelphic, and tail elongate conoid, about 5-6 anal body-widths long.

Type specieus: *Indoditylenchus sunderbanensis* n. gen., n. sp.

Relationship: The new genus *Indoditylenchus* comes close to *Ditylenchus* Filipjev, 1936 but differs from it in having nonannulated cuticle, lateral fields without incisures and the excretory pore anterior to the median oesophageal bulb (5% of the oesophageal length from anterior end). The new genus also come close to *Sychnotylenchus* Ruhm, 1956 in having excretory pore anterior to the median bulb but differs in having elongate conoid tail and V=80-82 (female tail short, stout and rounded; V=90 in *Sychnotylenchus*). Moreover, *Sychnotylechus* is associated with insects.

INDODITYLENCHUS SUNDARBANENSIS N.GEN., N.SP.

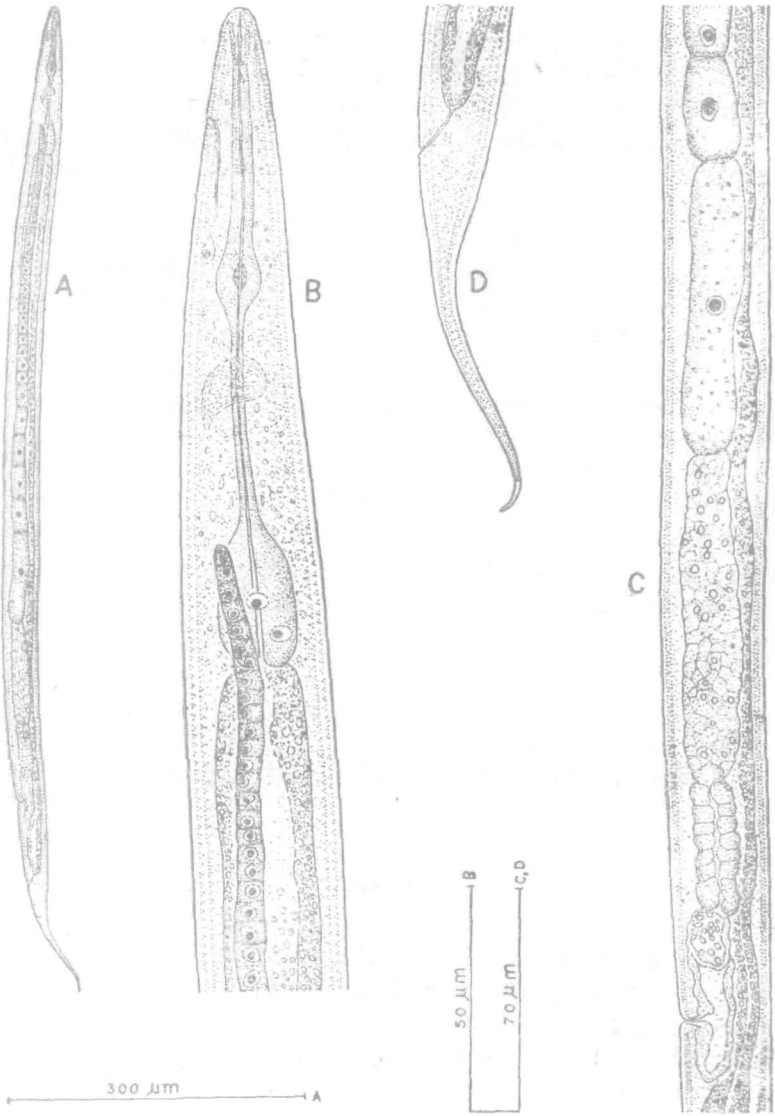
MEASUREMELTS

Holotype: (F) : L=1.00 mm; a=36; b=6.7; c=8.4; V=82.

Paratype: (FF):
L=0.76- 1.00 mm; a=36-50; b=5.4- 7.0;
c=7-9; V=80-82.

DESCRIPTION

FEMALE: Body almost straight upon fixation and tapering slightly towards both extremities. Cuticle nonannulated but marked with fine transverse striae like dorylaimids. Longitudinal lines absent. Lateral fields without incisures. Lip region smooth, continuous with the body, 6.0-6.5 μm wide and 2.0-2.5 μm high. Head framework weakly sclerotized. Stylet 12-12.5 μm long, about two times the head width;



Indoditslechus Sudarbanensis N. Gen.; N. sp.

Fig. A. Entire female., B. Anterior region. C.; Female reproductive system.; D. Female tail.

its anterior part (metenchium) 6-6.5 μm long 50-52% of the stylet length. The basal knobs of the stylet rounded, about 2 μm wide. Orifice of the dorsal oesophageal gland 2.0-2.5 μm from stylet base. Median bulb at 42-45% of the oesophageal length from anterior end; 10-12X14-15 μm. Isthmus narrow, gradually expanding to form the posterior bulb which does not overlap the intestine. Nerve ring 80-98 μm or 60-65% of the oesophageal length from anterior extremity. Excretory pore 23-30 μm or 4.5-5.5% of the oesophageal length from anterior end. Hemizonid could not be seen. Rectum 10-12 μm long or about $\frac{1}{2}$ of the body width long. Vulva a transeverse slit. Vagina 9-10 μm about 1/3rd of the corresponding body width. Female reproductive system mono-prodelphic, outstretched. The sexual branch consists of an ovary, partly muscular and partly glandular oviduct, spermatheca and uterus. Spermatheca filled with sperms. Overy very long, extending up to the anterior end of the basal oesophageal bulb; ocytes arranged in a single row. Posterior uterine sac 19-22 μm long or about $\frac{1}{4}$ of the corresponding body-width. Tail elongate-conoid, with rounded terminus, 98-125 μm or 5-6 anal bady widths long. Phasmids indistinct.

MALE: Not found.

Type habitat and locality Detritus rich mangrove litter soil around roots of *Avicennia officinalis*: Prentice Island, Sundarbands, West Bengal India.

SUMMARY

A new genus and new species *Indoditylenchus sundarbanensis* is being described from Prentice Island Sundarbans, West Bengal. The new genus is being compared with *Ditylenchus* Filipjev, 1936 and *Sychnotylenchus* Rhum, 1956 of the family Tylenchidae. The new genus is characterised by having non annulated cuticle, lateral fields without incisures and excretory pore anterior to the median oesophageal bulb (about 5% of the oesophageal length from anterior extremity).

ACKNOWLEDGEMENT

We are thankful to Dr. B. K. Tikader, Director of Zoological Survey of India, Calcutta for providing the research facilities. Thanks are also due to the authorities of S.D. Marine Biological Research Institute, Sagar Island for their cordial assistance during field survey.

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NEMATODES FROM WEST BENGAL (INDIA). XX. MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN *HIRSCHMANNIELLA GRACILIS* (DE MAN, 1880) LUC & GOODEY, 1963 (RADOPHOLIDAE : TYLENCHIDA : NEMATODA)

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INTRODUCTION

Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963 has been found a key pest of paddy crop in West Bengal which is one of major rice producing states in India (Baqri *et. al.*, 1983 ; Baqri & Das, in press). In view of the economic importance and wide distribution of *H. gracilis* in West Bengal, it was felt necessary to study the morphometric and allometric variations so that the reliable characters may be established for its identification. The present observations are based on a single population collected from village Mamna, district West Dinajpur, West Bengal.

MATERIAL AND METHOD

The nematodes were fixed in hot 4% formalin, dehydrated in the descicator and mounted in anhydrous glycerine. The specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

HIRSCHMANNIELLA GRACILIS (de Man, 1880) Luc & Goodey, 1963

(Figs. 1-3).

DIMENSIONS : TABLE—I.

DESCRIPTION :

FEMALE : Body slightly ventrally curved posterior to oesophagus

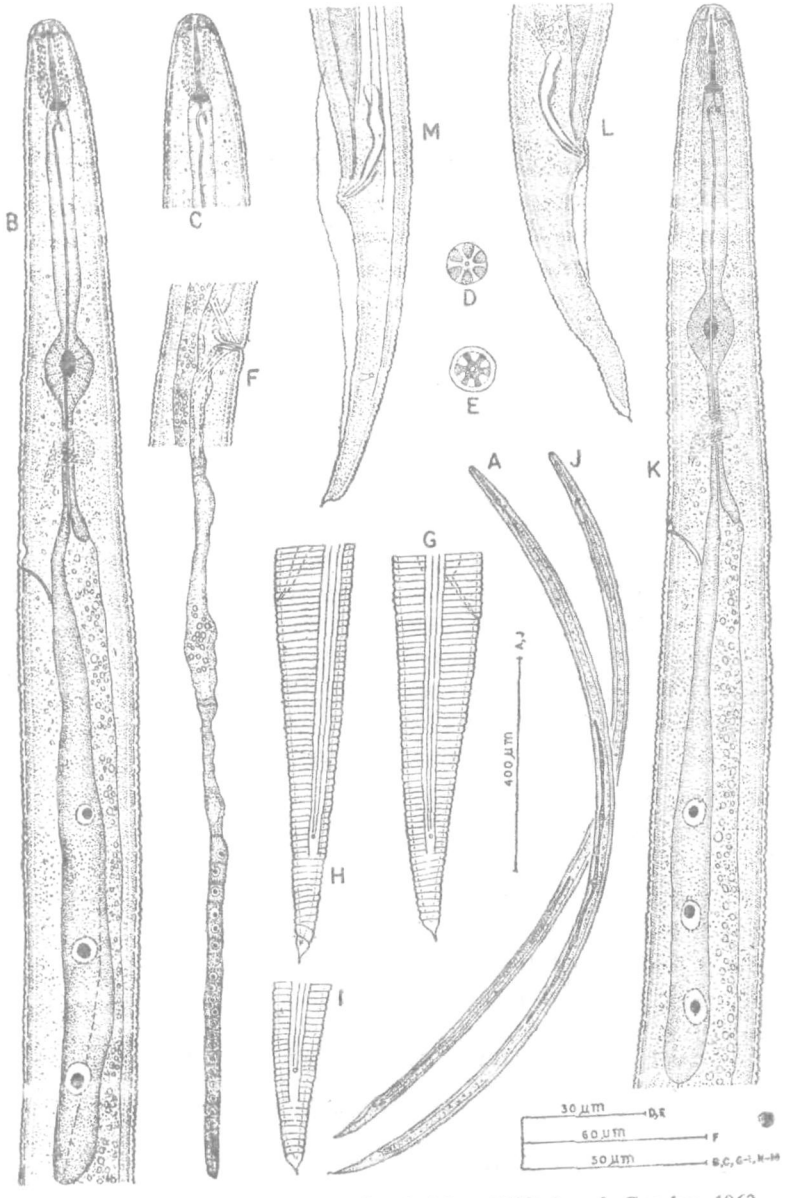


Fig. 1. *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963. A–I: Female. A—Entire female, B & C—Anterior region of female, *D—En face view*, E—C. S. at the level of head base, F—Female reproductive system (posterior branch). G—I—Female tails. J—M; Male. J—Entire male, K—Anterior region, L & M—male tails.

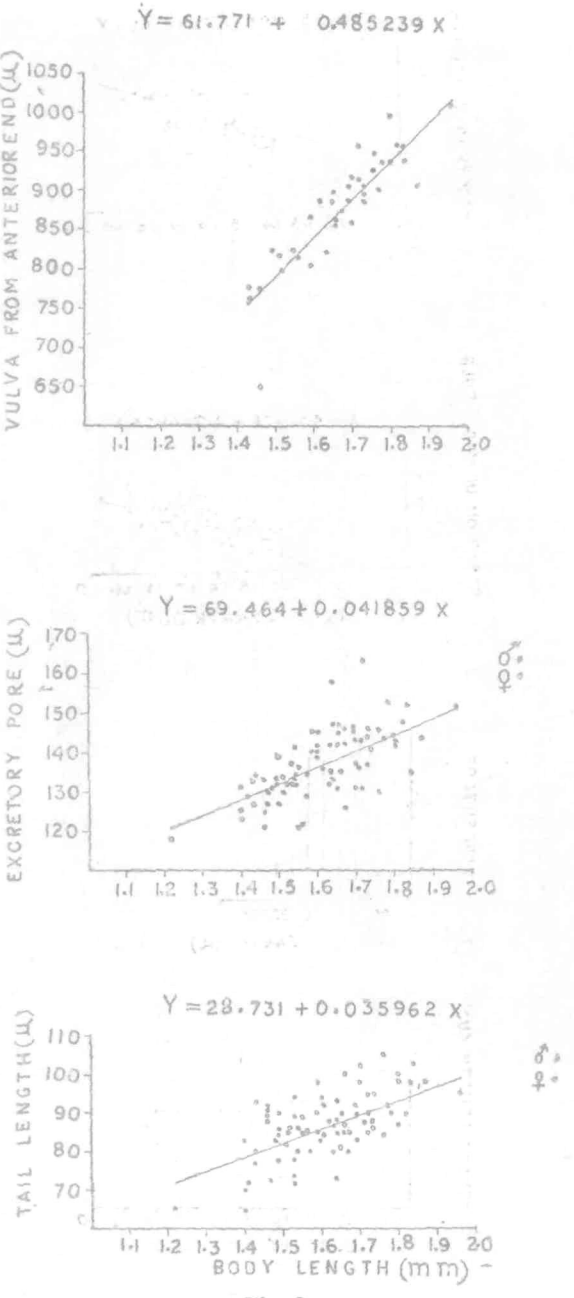
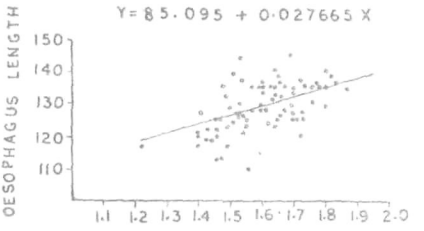
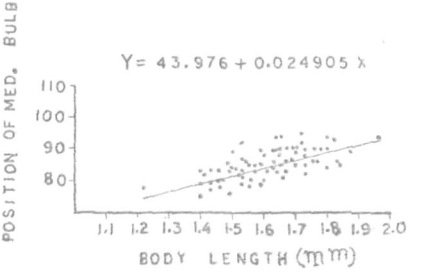
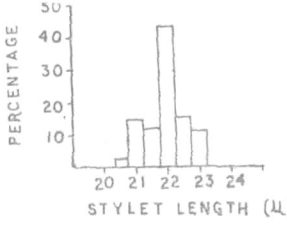

Y= 61.771 + 0.485239 X
VULVA FROM ANTERIOR END (μ)
1050
1000
950
900
850
800
750
700
650
1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Y = 69.464 + 0.041859 X
EXCRETORY PORE (μ)
170
160
150
140
130
120
1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
♂
♀
Y = 28.731 + 0.035962 X
TAIL LENGTH (μ)
110
100
90
80
70
1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
BODY LENGTH (mm)
♂
♀

Fig. 2


Y= 85.095 + 0·027665 X
OESOPHAGUS LENGTH
150
140
130
120
110
1·1 1·2 1·3 1·4 1·5 1·6 1·7 1·8 1·9 2·0


Y= 43.976 + 0.024905 X
POSITION OF MED. BULB
110
100
90
80
1·1 1·2 1·3 1·4 1·5 1·6 1·7 1·8 1·9 2·0
BODY LENGTH (mm)


PERCENTAGE
50
40
30
20
10
20 21 22 23 24
STYLET LENGTH (μ)

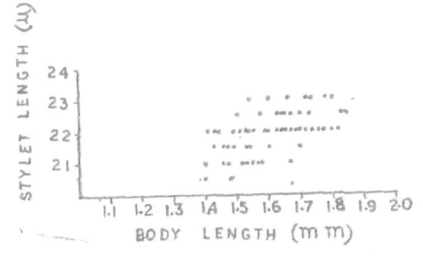

STYLET LENGTH (μ)
24
23
22
21
1·1 1·2 1·3 1·4 1·5 1·6 1·7 1·8 1·9 2·0
BODY LENGTH (mm)

Fig. 3

upon fixation. Cuticle marked with distinct transverse striae, 1.2–2.0 μm apart. Lateral fields 1/6th—1/4th of body-width near middle ; marked with four incisures, the outer ones are crenate ; aerolations absent.

Head continuous with body, apex flattened to slightly hemispherical, marked with 3—5 annules, with a well developed cephalic framework. Stylet robust, 21—23 μm long or about 1.9—2.1 times the head-width. The anterior part of the stylet (metenchium) is 10.5—13.0 μm long or 47.7—54.5% of the stylet length. The basal knobs rounded, slopping down wards, 4.5—5.5 μm wide.

Oesophagus typical to the genus. Median oesophageal bulb at 60—67% of the oesophageal length from anterior end, 18—23 × 11.0—14.5 μm. Oesophageal glands lobed, overlapping intestine ventrally. Orifice of the dorsal oesophageal gland 2—3 μm below the base of the stylet. The nerve ring 74—83% of the oesophageal length from anterior extremity. Excretory pore 97—115% of the oesophageal length from anterior end, generally located posterior to the oesophago-intestinal junction (Fig. 1 : B), but in a few specimens located slightly anterior to the latter (Fig. 1 : A). Hemizonid 2—3 annules long, situated 0—2 annules anterior to the excretory pore, sometimes the hemizonid overlaps the excretory pore.

Vulva varies from pre-equatorial (10% specimens) to post-equatorial (90% specimens). Vagina 1/3rd—1/2 of corresponding body-width. Reproductive system amphidelphic. Each sexual branch consists of an uterus, a spermatheca, an oviduct and an ovary. Spermatheca filled with sperms (Fig. 1 : F). Oocytes arranged in a single row except the growth region. Tail cylindrical, terminus with a pointed ventral projection, 77—105 μm or 3.4—5.9 anal body-width long. Phasmids located in posterior half of the tail, 24—41% of the tail length from tail terminus.

MALE : Similar to female in general shape and morphology except the reproductive system and the tail shape. Bursa sub terminal (Fig. 1 : M). Gubernaculum curved. Spicules 28—35 μm long when measured along the median line. Tail slightly curved, 65—94 μm or

TABLE I

MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN ADULTS OF *HIRSCHMANNIELLA GRACILIS* (40 FF, 40 MM)

Characters	*Female*		
Characters	Range	Mean ± S.D.	S.E.
Length (mm)	1.43—1.96	1.68±0.12	0.02
a	41.8—60.8	53.20±5.43	0.86
b	11.6—16.7	13.0±0.90	12.11
b′	4.5—6.5	5.45±0.59	0.09
c	16.2—21.0	18.62±1.36	0.22
c′	3.4—5.9	4.21±0.57	0.09
V/T	48.0—54.0	51.82±1.46	0.23
G_1	16.0—24.0	18.66±2.02	0.32
G_2	15.0—23.0	18.30±2.04	0.32
O	8.9—13.6	11.46±1.70	0.27
m	50.6—65.7	59.04±4.00	0.63
Cut. at mid. body (μm)	0.8—1.5	1.11±0.19	0.03
Annules (μm)	1.2—2.0	1.75±0.20	0.03
Lateral fields (μm)	5.0—12.0	7.36±1.70	0.27
Head-width (μm)	10.0—12.0	10.92±0.90	0.14
Head height (μm)	4.0—5.0	4.95±0.22	0.03
Stylet (μm)	21.0—23.0	22.15±0.60	0.10
Stylet knobs (μm)	4.5—5.5	5.00±0.27	0.04
Metenchium (μm)	10.5—13.0	11.47±0.55	0.09
D. oeso. gl. opening (μm)	2.0—3.0	2.54±0.40	0.06
Oesophagus* (μm)	118.0—149.0	129.80±7.46	1.18
Oeso. overlap** (μm)	125.0—240.0	164.40±34.05	5.38
Median bulb (μm)	18—23×11—15	20.7×12.6± 1.27×1.12	0.20×0.37
Med. bulb* (μm)	77.0—95.0	86.1±4.58	0.72
Nerve ring* (μm)	92.0—123.0	109.3±6.38	1.01
Excretory pore* (μm)	121.0—163.0	138.7±9.41	1.49
Vulva* (μm)	650—1008	879±70.51	11.14
Vagina (μm)	8—18	12.78±1.84	0.29
Vulva body-width (μm)	26—42.5	31.12±3.76	0.59
Ant. gonad (μm)	250—450	319.62±35.80	5.66
Post. gonad (μm)	235—430	316.25±38.65	6.11
Anal b.w. (μm)	21—29	21.78±2.75	0.44
Rectum (μm)	15—26	19.25±3.10	0.49
Tail annules (No.)	52—70	59.57±6.14	0.96
Tail length (μm)	77—105	90.65±6.84	1.08
Spicules (μm)	———	———	——
Gubernaculum (μm)	———	———	——

*Distance from anterior end

**Distance from oesophago-intestinal junction

contd.

Male				
C V. (%)	Range	Mean ± S.D.	S.E.	C.V. (%)
7.61	1.22—1.71	1.54±0 10	0.02	6.47
10.22	42.2—62.0	49.81±4.39	0.70	8.83
6.53	10.4—13.7	12.0±0.69	0.11	5.75
10.98	4.1—7.2	5.6±0.72	0.11	12.91
7.33	15.5—22.5	18.8±1.59	0.25	8.48
13.73	3.4—6.0	4.4±0.49	0.08	11.24
2.83	25.0—44.0	34.72±3.61	0.57	10.41
10.85	— — —	— — — —	— — —	— — —
11.14	— — — —	— — — —	— — —	— — —
14.86	9.0—13.6	10.70±1.56	0.25	14.61
6.77	51.6—66.1	58.76±3.44	0.54	5.85
17.72	0.9—1.5	1.05±0.11	0.02	11.14
11.71	1.5—1.9	1.70±0.12	0.02	10.41
23.16	5.0—9.5	7.02±1.19	0.19	17.05
8.32	10.0—12.0	10.42±0.59	0.09	5.70
4.44	4.0—5.0	4.97±0.15	0.02	3.18
2.71	20.5—23.0	21.72±0.57	0.09	2.65
5.43	4.5—5.5	4.82±0.37	0.06	7.68
4.83	10.5—12.5	11.40±0.55	0.08	4.77
15.74	2.0—3.0	2.35±0.36	0.06	15.36
5.75	117.0—145.0	128.97±7.37	1.17	5.72
20.71	88.0—222.0	151.65±37.95	5.90	25.03
6.15×8.94	18—23×10—13	20.15×11.95± 1.23×0.84	0.19×0.13	6.11×7.07
5.32	75.0—94.0	84.32±4.79	0.76	5.69
5.84	93.0—119.0	106.90±5.70	0.90	5.34
6.97	123.0—158.0	135.30±7.62	1.21	5.63
8.02	— — — —	— — — —	— — —	— — —
14.41	— — — —	— — — —	— — —	— — —
12.04	— — — —	— — — —	— — —	— — —
11.20	— — — —	— — — —	— — —	— — —
12.22	— — — —	— — — —	— — —	— — —
12.63	15—22	19.0±1.43	0.23	7.56
16.11	— — — —	— — — —	— — —	— — —
10.32	— — — —	— — — —	— — —	— — —
7.55	65—94	82.85±7.74	1.22	9.34
— — —	28—35	30.25±2.10	0.33	0.97
— — —	9—13	10.35±0.94	0.15	9.16

3.5—6.0 anal body-widths long, with a pointed ventral projection.

Morphometric and Allometric Characters

The measurements and the statistical analysis of the various characters of adults (males and females) have been furnished in Table-I. The position of the excretory pore and vulva, and the tail length are significantly correlated with the body length ; the coefficient of correlation (r)=0.667, 0.895 and 0.578 respectively. Fig. 2 shows the relationship of body length with the position of excretory pore and vulva, and tail length. The length of oesophagus and median bulb have less correlation with the length (r=0.460 and 0.310 respectively). The length the of gonads and stylet are not correlated at all with the body length (Fig.3).

The statistical analysis reveals that the stylet length and its metenchium are least variable characters (CV=2.71 and 4.83 respectively). The value of V is one of the least variable characters (CV=2.83) while G_1 and G_2 exhibit high degree of variability (CV=10.85 and 11.14 respectively). The length of body, oesophagus; position of median bulb, nerve ring and excretory pore from anterior end ; and the value of b and m are being found moderately variable (CV=5—8). The value of a, b', 0 and T have shown a high degree of variability (CV=>8). The female tail length and value of c are moderately variable (CV<8). In males, the length of spicules is a moderately variable character while the length of gubernaculum, the position of phasmids, value of c and c' have been found highly variable characters CV=>8).

These results have been found similar to the findings of Bird and Mai (1967) in *Trichdorus christei* Allen, 1957 ; partly with Azmi and Jairajpuri (1978) in *Helicotylenchus indicus* Siddiqi, 1963 ; Baqri and Ahmad (1981) in *Tylenchorhynchus nudus* Allen, 1955 ; Baqri & Ahmad (1984) in *Helicotylenchus crenacauda* Sher, 1966 ; and others.

Remarks : Sivakumar & Khan (1982) in their key to species of *Hirschmanniella* have separated *H. gracilis* from *H. oryzae* (Soltwedel, 1889) Luc & Goodey, 1963 on the following characters : Lateral fields completely or incompletely areolated and excretory pore opposite to oesophago-intestinal valve in *H. gracilis* against lateral fields incompl-

etely or not areolated and excretory pore posterior to oesophago-intestinal valva in *H. oryzae*. The present study reveals that the position of excretory pore varies from anterior to posterior of oesophago-intestinal valve and statistically it is moderately variable character. Moreover, its position is significantly correlated with the body length. Hence, the position of excretory pore should not be used as a key characters in the identification of *H. gracilis*. As far as the areolation in the lateral fields is concerned, its visibility depends upon the fixation technique, and thus can not be used to differentiate the species from closely related species.

In our opinion, the length of stylet should always be used as a key or main character to distinguish *H. gracilis* from *H. oryzae* (stylet length 20—23 μm in *H. gracilis* against 15—19 μm in *H. oryzae*). Moreover, the length of stylet is one of the least variable characters and independent of body length. The males of *H. gracilis* can further be differentiated from males *H. oryzae* in having bigger spicules (27—38 μm long against 18—26 μm in *H. oryzae*.)

HABITAT AND TYPE LOCALITY : From soil around roots of rice, *Oryza sativa* at Mamna, District West Dinajpur, West Bengal.

SUMMARY

The study of a single population of *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 reveals that the length of stylet and the value of V are less variable characters. The body length, oesophageal length; the position of the nerve ring, excretory pore and the median bulb are moderately variable characters (CV=5—8). The characters which have shown a high degree of variability (CV= $\geq$ 8) are the value of a, b′, c′; length of anterior and posterior sexual branches ; oesophageal overlap ; and the position of phasmids.

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A TAXONOMIC REVISION OF THE NEMATODE SPECIES (DORYLAIMIDA) REPORTED BY KHERA (1970) FROM INDIA

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ABSTRACT

Out of 11 nematode species reported by Khera (1970) from the bank of still and running water from India, the specimens of 5 species are available in the National Zoological Collections of the Zoological Survey of India, Calcutta. These specimens were re-examined and it was noted that the taxonomical status of some needed revision. Moreover, the descriptions and illustrations as provided by Khera were also inadequate. The present paper reports the changes in the taxonomical status of the following species : *Dorylaimus stagnalis* Dujardin, 1845 from Jodhpur as *Laimydorus finalis* Thorne, 1975 ; *Dorylaimus ruwenzorii* apud Khera, 1970 as *Mesodorylaimus* sp. ; *Dorylaimus multialaeus* Khera, 1970 transferred to *Laimydorus*. The male of *Eudorylaimus odhneri* apud Khera, 1970 along with an unidentified female on the same slide represents a new species *Laimydorus kherai*.

The status of *Dorylaimus stagnalis* apud Khera, 1970 partim from Lucknow, a single female of *Eudorylaimus odhneri* and *Actinolaimus omercooperi* remains unchanged.

INTRODUCTION

Khera (1970) reported 11 nematode species including two new of the Order Dorylaimida from the banks of still and running waters in Uttar Pradesh, Rajasthan and Kerala. These species were inadequately described and illustrated and for some only the body dimensions were provided. The specimens were deposited in the Nematode Collection of the Zoology Museum of Jodhpur University, Rajasthan where Dr. Khera was a Reader in the Zoology Department till 1969. However, in the same year he joined the Zoological Survey of India, Calcutta. Subsequently he shifted most of his nematode slides from Jodhpur and registered the same in the National Zoological Survey of India, Calcutta.

The present author was able to trace some of the registered specimens of five species reported by Khera (1970). A study of these revealed that the identification of some species was not correct. Unfortunately, the majority of the specimens were not properly preserved.

The present paper reports the revised identification of the specimens of five species, out of 11, reported by Khera (1970). The following table provides the present status of

all the species. The asterisk indicates that the specimens of the species are not traceable. The status of the nontraceable species has not been changed except *Labronema* sp. which was identified only on a single juvenile specimen.

Status of the species reported by Khera (1970)

Past	Present
1. *Dorylaimus stagnalis* Dujardin, 1845 from Lucknow and Jodhpur	(i) Lucknow population = *D. stagnalis*
	(ii) Jodhpur population = *Laimydorus finalis* Thorne, 1975
2. *Dorylaimus ruwenzorii* de Coninck, 1935 (= *Mesodorylaimus ruwenzorii*) from Pachhapadra (Rajasthan)	*Mesodorylaimus* sp.
3. *Dorylaimus multialaeus* Khera, 1970 from Lucknow	*Laimydorus multialaeus* (Khera, 1970) N. Comb.
4. *Mesodorylaimus biroi** (Daday, 1899) Andrássy, 1959	*M. biroi*
5. *Mesodorylaimus centrocercus** (de Man, 1880) Geraert, 1966	*M. centrocercus*
6. *Eudorylaimus odhneri* (Allgen, 1950) Andra'ssy, 1959	(i) *Eudorylaimus odhneri*
	(ii) *Laimydorus kherai* n. sp.
7. *Eudorylaimus udaipuriensis** Khera, 1970	*Eudorylaimus udaipuriensis*
8. *Labronema* sp. (juvenile)	?
9. *Actinolaimus omercooperi* Filipjev, 1931	*Actinolaimus omercooperi*
10. *Actinolaimus costatus** Schneider, 1935	*Actinolaimus costatus*
11. *Nygolaimus intermedius** (de Man, 1880)	*Nygolaimus intermedius*

Dorylaimus stagnalis Dujardin, 1845

(Fig. 1, E-H)

Measurements :

Females (4) : L = 3.79-4.35 mm ; a = 38-46 ; b = 4.5-5.6 ; c = 17-20 ; V = $^{14\text{-}15}40\text{-}44^{12\text{-}17}$.

Males (3) : L = 3.04-3.30 mm ; a = 30-33 ; b = 4.2-4.8 ; c = 78-87 ; T = 59-65.

DESCRIPTION

Female : Body straight or slightly ventrally curved posterior to vulva, tapering gradually towards both extremities. Cuticle finely striated, 5-9 μm thick (thickest on tail), marked with 32-34 longitudinal lines in the middle and at base of oesophagus. Lateral chords $\frac{1}{4}$th-$\frac{1}{3}$rd of the corresponding body-width near middle. Dorsal and ventral body pores 6-8 and 25-27 respectively. Lateral body pores 89-99 (2 females), of which 18-21 in oesophageal region, 68-76 in intestine and prerectum region and 3 in caudal region.

Lip region rounded, slightly marked by a depression, 1/1.45-1/5.5 body-width at base

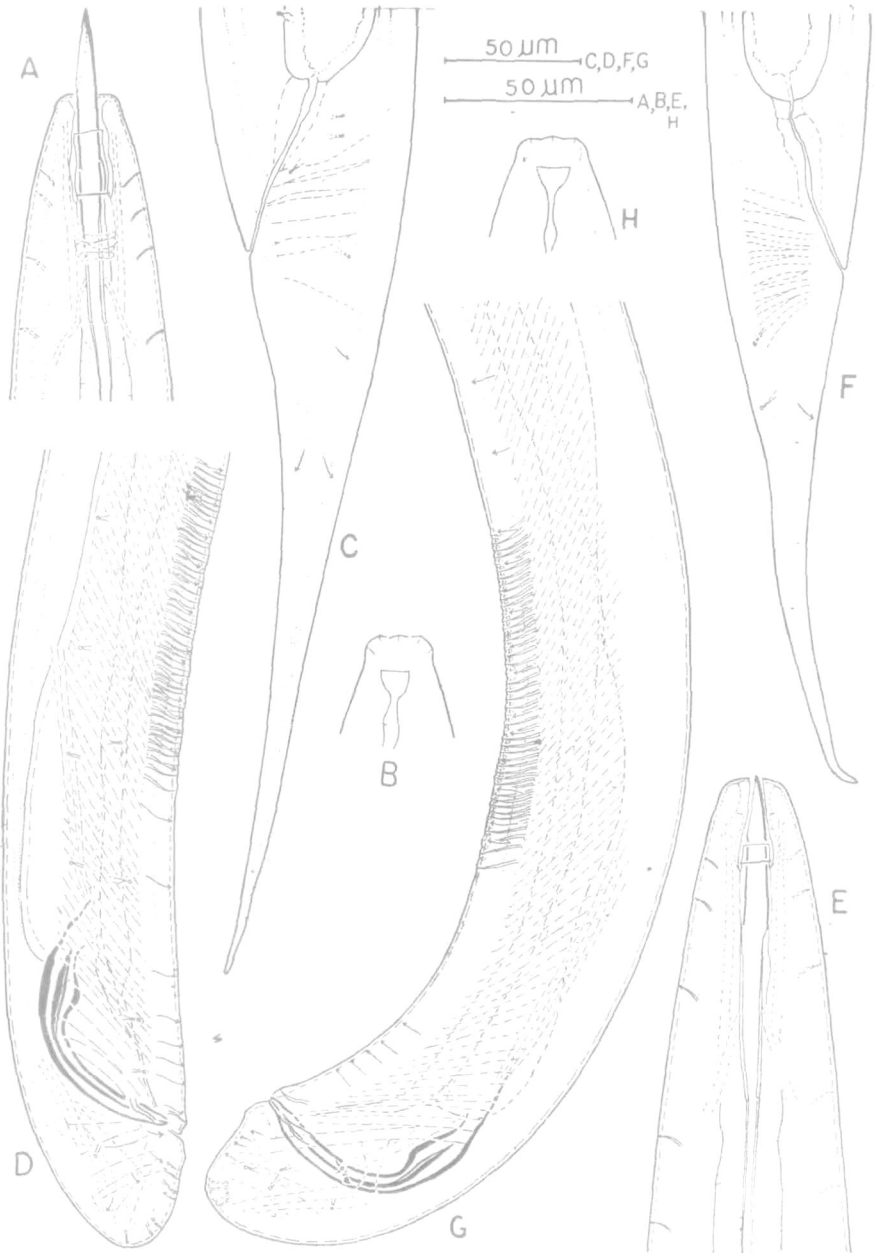

Fig. 1. A—D : *Laimydorus finalis* Thorne, 1975, A—Anterior end; B—Surface view of anterior end, C—Female tail, D—Posterior region of male. E—H : *Dorylaimus stagnalis* Dujardin, 1845, E—Anterior end, F—Female tail, G—Posterior region of male, H—Surface view of anterior end.

of oesophagus. Lips amalgamated bearing the usual number of papillae. Amphids stirrup-shaped, apertures occupying 9-10 μm or slightly less than half of the corresponding body-width and 7-8 μm from anterior end. Sensillar pouches 16-18 μm from amphidial slits.

Odontostyle 40-45 μm or 2.0-2.2 lip region-widths long, aperture 16-18 μm or 35-41% of the odontostyle length. Guiding ring 22-24 μm or 1.0-1.1 lip region-width from anterior end. Odontophore 46-53 μm or about 1.0-1.2 times the odontostyle length. Basal expanded part of oesophagus occupies 51-53% of the oesophageal length. The locations of the oesophageal gland nuclei and their orifices could not be observed. Nerve ring 186-200 μm or 24-26% of the neck region from anterior end. Oesophago-intestinal disc present. Cardia-conoid, enveloped by intestinal tissue. Prerectum 230-295 μm or 5.0-7.0 anal body-widths long. Rectum 60-65 μm or 1.3-1.4 anal body-widths long.

Vulva transverse. Vagina 43-45 μm or extending less than half way across body. Reproductive system amphidelphic. Uterus and oviduct separated by a sphincter. Oocytes arranged in a single row except in the growth region. Tail elongate, tapering gradually, 200-222 μm or about 5 anal body-widths long, with 3 caudal pores on each side.

Male : Similar to female in general shape and morphology except for the tail and male reproductive system. Odontostyle 42-45 μm or 2.0-2.2 lip region-widths long, aperture 15-17 μm or 34-38% of odontostyle length. Odontophore 45-49 μm or about 1.1 times the odontostyle length. Reproductive system typical. Supplements consist of an adanal pair and a series of 42-48 contiguous ventromedians. The first ventromedian supplement situated at about 2.5 anal body-widths from the cloacal opening. Subventral papillae 17-21, irregularly spaced. Spicules 98-108 μm or 1.7-2.1 anal body-widths long when measured along the curved median line. Lateral guiding pieces 18-21 μm long. Copulatory muscles 68-80, extending beyond the supplement region. Prerectum 350-440 μm or 6.4-8.6 anal body-widths long. Tail bluntly rounded, 35-39 μm or 0.6-0.7 anal body-width long, with 10-12 caudal pores on each side.

Habitat and locality : From the banks of ditches at Nadwa and Pyagpur House area, Lucknow (U. P.)

Remarks : Khera (1970) identified these specimens as *D. stagnalis* from Lucknow and reported them along with the misidentified population from Jodhpur. The present study of the Lucknow population confirms that this population may be accommodated under *D. stagnalis*. However, these specimens differ from *D. stagnalis* in having slightly rounded lip region and shorter odontostyle.

Mesodorylaimus sp.

Syn. **Dorylaimus ruwenzorii** apud Khera, 1970

Nec **Dorylaimus ruwenzorii** De Coninck, 1935

= **Mesodorylaimus ruwenzorii** (De Coninck, 1935) Andrássy, 1959

(Fig. 4, A-B)

Measurements :

Female (1) : L = 1.22 mm ; a = 42 ; b = 5.0 ; c = 18.4 ; V = $^{12}44.4^{15}$.

DESCRIPTION

Female : Body irregularly curved upon fixation, tapering gradually towards both ends. Cuticle about 2 μm thick, finely striated transversely. Lateral chords 1/3.5 of body-width near middle. Ventral, dorsal and lateral body pores not seen.

Lip region offset from body by a constriction, about $\frac{1}{4}$th of body-width at base of oesophagus. Amphidial pouches not seen. Odontostyle 13 μm or 1.8 lip region-widths long, aperture 4.5 μm or about 35% of the odontostyle length. Guiding ring 7.2 μm or 0.9 lip region-width from anterior end. Odontophore 15.5 μm or about 1.2 times the odontostyle length.

Basal expanded part of oesophagus occupying about 40% of the neck region. Oesophageal gland neclei and their orifices not visible. Cardia short, rounded. Nerve ring 85 μm or about 33% of the neck region from anterior end. Prerectum 66 μm or about 4.5 anal body-widths long. Rectum 21 μm or 1.5 anal body-widths long.

Vulva transverse, flushed with body. Vagina 15 μm or slightly less than $\frac{1}{2}$ of the corresponding body-width. Reproductive system amphidelphic. Uterus and oviduct separated by a sphincter. Oocytes arranged in a single row except in the growth region.

Tail elongate-conoid, 67 μm or about 4.7 anal body-widths long. Caudal pores not seen.

Habitat and locality : From the banks of sline ditch at Pachhapadra, Rajasthan.

Remarks : Since *D. ruwenzorii* de Coninck, 1935 had already been transferred by Andrássy (1959) to his newly proposed genus *Mesodorylaimus*, Khera (1970) must have reported Pachhapadra population (3 ♀ ♀) as *M. ruwenzorii*. Out of 3 females, only one female, mounted on slide W 7192/1 along with juvenile of some unidentified dorylaim species, was available which confirms that the longitudinal ridges (32) reported by Khera (l.c.) are not present. The present study also reveals that the single available female belongs to the genus *Mesodorylaimus* but it differs from *M. ruwenzorii* in having shorter odontostyle, odontophore and tail (odontostyle 16 μm, odontophore about 1.5 times the odontostyle length and c=10 in *M. ruwenzorii*). However, Khera had measured the odontostyle 10-11 μm and calculated the value of c=9 – 13.5.

Unfortunately, it was not possible to identify this specimen to species level because of bad preservation. Hence, it has been reported as *Mesodorylaimus* sp.

Laimydorus multialaeus (Khera, 1970) N. Comb.

Syn. **Dorylaimus multialaeus** Khera, 1970

(Fig. 2)

Measurements :

Females (3) : L=2.42-2.58 mm ; a=35-38 ; b=5.3-5.9 ; c=10.0-12.4 ; $V=^{15\text{-}18}_{43\text{-}47}{}^{21\text{-}23}$.

Males (2) : L=2.01-2.17 mm ; a=37-39 ; b=4.4-4.8 ; c=96-109 ; T=64-66.

DESCRIPTION

Female : Body slightly ventrally curved in the posterior half, tapering gradually towards both extremities. Cuticle finely striated transversely, 3-6 μm thick (thickest on tail). Lateral chords slightly less than 1/3rd of

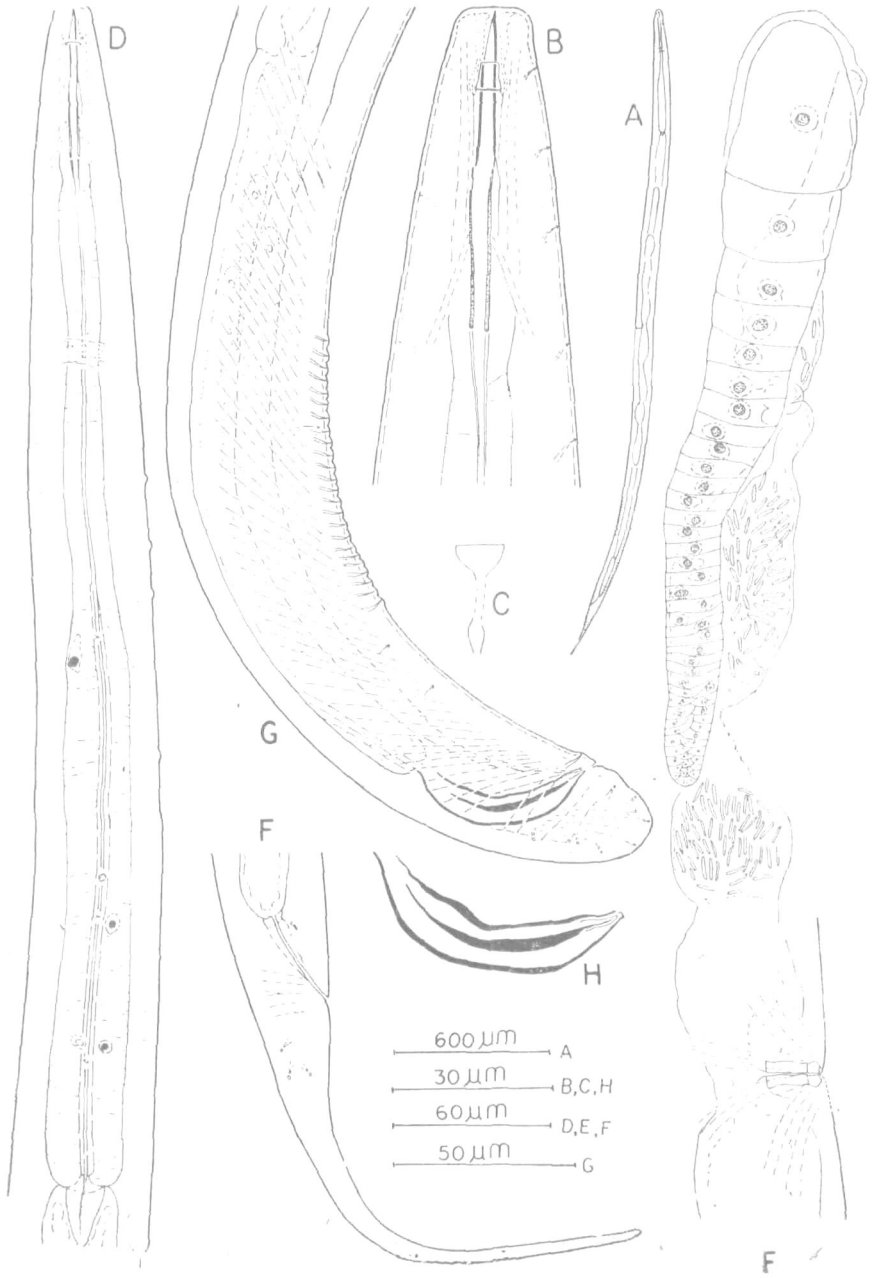

Fig. 2. A—H : *Laimydorus multialaeus* (Khera, 1970) n. comb., A—Entire female, B—Anterior end, C—Amphid, D—Anterior region, E—Anterior female reproductive system, F—Female tail, G—Posterior region of male, H—Spicule and lateral guiding piece.

body-width near middle. Lip region marked by a slight depression, bearing the usual number of papillae. Amphids stirrup-shaped, slits occupying 8-9 μm or 60% of the corresponding body-width, 6-7 μm from anterior extremity. Sensillar pouches 17-18 μm from amphidial slits. Odontostyle 25-28 μm or 1.6-1.9 lip region-width long ; aperture 10-12 μm or 36-42% of the odontostyle length. Odontophore 28-31 μm or about 1.1 odontostyle length. Guiding ring 14-15 μm or about one lip region-width from anterior extremity.

Basal expanded part of oesophagus occupying 48-51% of the neck region. Position of the oesophageal gland neclei and their orifices as follows :

DO = 52.6-53.9 S_1N_1 = 70-73 S_2N = 85-88
DN = 54.6-56.3 S_1N_2 = 75-77 S_2O = 87-90
DO-DN = 2.0-2.4

Nerve ring 125-138 μm or 27-30% of oesophageal length from anterior end. Cardia elongate conoid, about $\frac{1}{4}$th-$\frac{1}{3}$rd of the corresponding body-width long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 123-180 μm or 4-6 anal body-widths long. Rectum 37-38 μm or 1.2-1.5 anal body-width long.

Vulva transverse. Vagina 23-25 μm or about $\frac{1}{3}$rd of corresponding body-width long, sclerotized pieces present at vulva-vagina junction. Gonads amphidelphic. Uterus much longer than oviduct, spermatheca-like structure present, filled with sperms. Sperm 9-14 μm long. Egg 70-90 × 40-43 μm. Oocytes arranged in a single row except in the growth region.

Tail elongate-conoid, 200-256 μm or 7-10 anal body-widths long, with 3 caudal pores on each side.

Male : Similar to female in general shape and morphology except for the more curved posterior part of the body and differently shaped tail. Male reproductive system typical. Three pairs of ejaculatory glands in the prerectum region. Spicules 50-53 μm or 1.8-1.9 anal body-widths long medially. Lateral guiding pieces more or less rod-shaped, 9-11 μm long. In addition to one adanal, 23-24 contiguous ventromedian supplements present. Subventral papillae not visible except two between adanal and ventromedian supplement region. Prerectum starting anterior to the copulatory muscles, 232-320 μm or 8-13 anal body-widths long. Tail convex-conoid with rounded terminus, 20-21 μm or 0.7-0.8 anal body-width long, with 6-7 caudal pores on each side.

Habitat and locality : From the banks of a freshwater drain connected to a river near office of the Registrar, Lucknow University, Lucknow (U. P.).

Remarks : Khera (1970) described a new species, *D. multialaeus*, from Lucknow. Three female and 2 male paratypes are available in the National Collection of Zoological Survey of India on slide W. 7183 and W. 7184. The study of these paratypes confirms that they do not belong to the genus *Dorylaimus* Dujardin, 1845 because of the absence of the cuticular longitudinal lines and should be accommodated under the genus *Laimydorus* Siddiqi, 1969. Since these specimens do not fit with the descriptions of known species of the genus *Laimydorus*, a new combination is being proposed. *Laimydorus multialaeus* (Khera, 1970) n. comb. comes very close to *L. baldus* Baqri & Jana, 1982 but differs in the absence of pseudo 'Z' organs and presence of spermatheca-like structure in the uteri,

and slightly wider and differently shaped amphids.

Khera (1970) has reported the length of odontophore 38-42 μm and prerectum in female 100-108 μm which has been confirmed here as 28-31 μm and 123-180 μm respectively.

Laimydorus finalis Thorne, 1975

Syn. **Dorylaimus stagnalis** apud Khera, 1970 partim (Jodhpur population)

Nec **Dorylaimus stagnalis** Dujardin, 1845

(Fig. 1, A-D)

Measurements :

Female (1) : L = 4.11 mm ; a = 33 ; b = 5.4 ; c = 15 ; $V = {}^{14}_{40}{}^{19}$.

Male (1) : L = 3.14 mm ; a = 35 ; b = 4.4 ; c = 90 ; T = ?

DESCRIPTION

Female : Body slightly ventrally curved upon fixation and tapering towards both ends. Cuticle 5-8 μm thick (thickest at tail). Lateral hypodermal chords about $\frac{1}{3}$rd of body-width near middle. Dorsal, ventral and lateral body pores numerous but difficult to count precisely. Lateral body pores 136 or more, 35 in the oesophageal and 4 in the caudal region.

Lip region marked by a slight depression, about $\frac{1}{5}$ th of body-width at base of oesophagus. Amphids stirrup-shaped, apertures occupying 8-9 μm or slightly less than half of the corresponding body-width and 9-10 μm from anterior end. Sensillar pouches 17 μm from amphidial slits.

Odontostyle 45 μm or 2.0 lip region-width long ; aperture 21 μm or 47% of the odontostyle length. Guiding ring 28 μm or 1.3 lip region-width from anterior end. Odontophore 44 μm or about equal to odontostyle length. Basal expanded part of oesophagus occupies 53% of the oesophageal length. Locations of the oesophageal gland nuclei and their orifices could not be observed. Nerve ring 172 μm or 22% of the neck region from anterior end. Cardia with rounded tip, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 250 μm or 4.8 anal body-widths long. Rectum 64 μm or slightly more than anal body-width long.

Vulva a longitudinal slit. Vagina 58 μm long or 45% of the corresponding body-width, surrounded by sphincter, with moderately scelrotized distal region. Reproductive system amphidelphic. Uterus filled with oval sperms, 4-6 μm long. Uterus and oviduct separated by sphincter. Ovaries reflexed, oocytes arranged in a single row, double row and then in multiple rows at the region of growth.

Tail elongate conoid, 268 μm or 5.1 anal body-widths long, with 4 caudal pores on each side.

Male : Similar to female in general morphology except the tail shape and male reproductive system. Odontostyle 46 μm or 2.2 lip region-widths long, aperture 22 μm or 48% of the odontostyle length. Odontophore 40 μm or 0.9 of the odontostyle length. Reproductive system typical. Supplements consist of an adanal pair and a series of 47 contiguous ventromedians. The first ventromedian supplement situated at about 2.5 anal body-width from the cloacal opening. Subventral papillae 24, irregularly spaced,

Spicules 105 μm or 2.1 anal body-widths long when measured along with curved median line. Lateral guiding pieces 14 μm long. Copulatory muscles extending beyond the supplement region. Prerectum 318 μm or 6.3 times the anal body-width. Tail bluntly rounded, 35μm or 0.7 anal body-width long, with 12 caudal pores on each side.

Habitat and locality : From the bank of Kailana Lake, Jodhpur, Rajasthan.

Remarks : Khera (1970) reported 7 females and 6 males of *D. stagnalis* from Kailana Lake, Jodhpur but for the present study only a single female and a male (slide No. W 7188/1) were available. The study shows that Khera (l. c.) had misidentified Jodhpur population as *D. stagnalis* because these actually belong to *Laimydorus finalis* Thorne, 1975 and not *D. stagnalis*. The strong musculature was perhaps misinterpreted as longitudinal cuticular linings.

Laimydorus kherai n. sp.

Syn. **Eudorylaimus odhneri** apud Khera, 1970 partim (male)

Nec. **Dorylaimus odhneri** Allgen, 1951

= **Eudorylaimus odhneri** (Allgen, 1951) Andra'ssy, 1959

(Fig. 3, C—H)

Khera (1970) identified one female and a male as *Eudorylaimus odhneri* (Allgen, 1951) Andrássy, 1959 from Suraj Kund, Lucknow. These two specimens along with two other females marked as unidentified dorylaims have been found on slide W 7193/1. The present study shows that the male reported by Khera (l. c.) as that of *Eudorylaimus odhneri* actually belongs to *Laimydorus*. This male and one unidentified female on the same slide represent a new species which is named as *L. kherai* n. sp. The second unidentified female on the same slide also belongs to *Laimydorus* but the identification could not be confirmed because it has shifted below the sealing material of the cover slips.

Measurements :

Holotype female (1) : L = 2.92 mm ; a = 45 ; b = 5.1 ; c = 12 ; V = $^{19.6}_{44}$ 21.4.

Paratype male (1) : L = 2.49 mm ; a = 50 ; b = 4.2 ; c = 12 ; T = 59.

Description

Female : Body ventrally curved posterior to vulva upon fixation and tapering towards both ends. Cuticle finely striated ; 4-6 μm thick (thickest at tail). Lateral hypodermal chords about $\frac{1}{3}$rd of corresponding body-width near middle. Dorsal, ventral and lateral body pores could not be counted because of the dorsoventral position of the specimen in the posterior region.

Lip region almost continuous. Amphids stirrup shaped, apertures occupying 7 μm or about half of the carresponding body-width and 6.5 μm from anterior end. Sensillar pouches could not be observed. Odontostyle 31 μm or 1.7 lip region-width long ; aperture 11.5 μm or 27% of the odontostyle length. Guiding ring 18 μm or one lip region width from anterior extremity. Odontophore 35 μm or 1.1 times the odontostyle length. Basal expanded part of oesophagus occupies 44% of the oesophageal length. Locations of oesophageal gland nuclei and their orifices not clear. Nerve ring 172 μm or 33% of the neck region from anterior end. Cardia

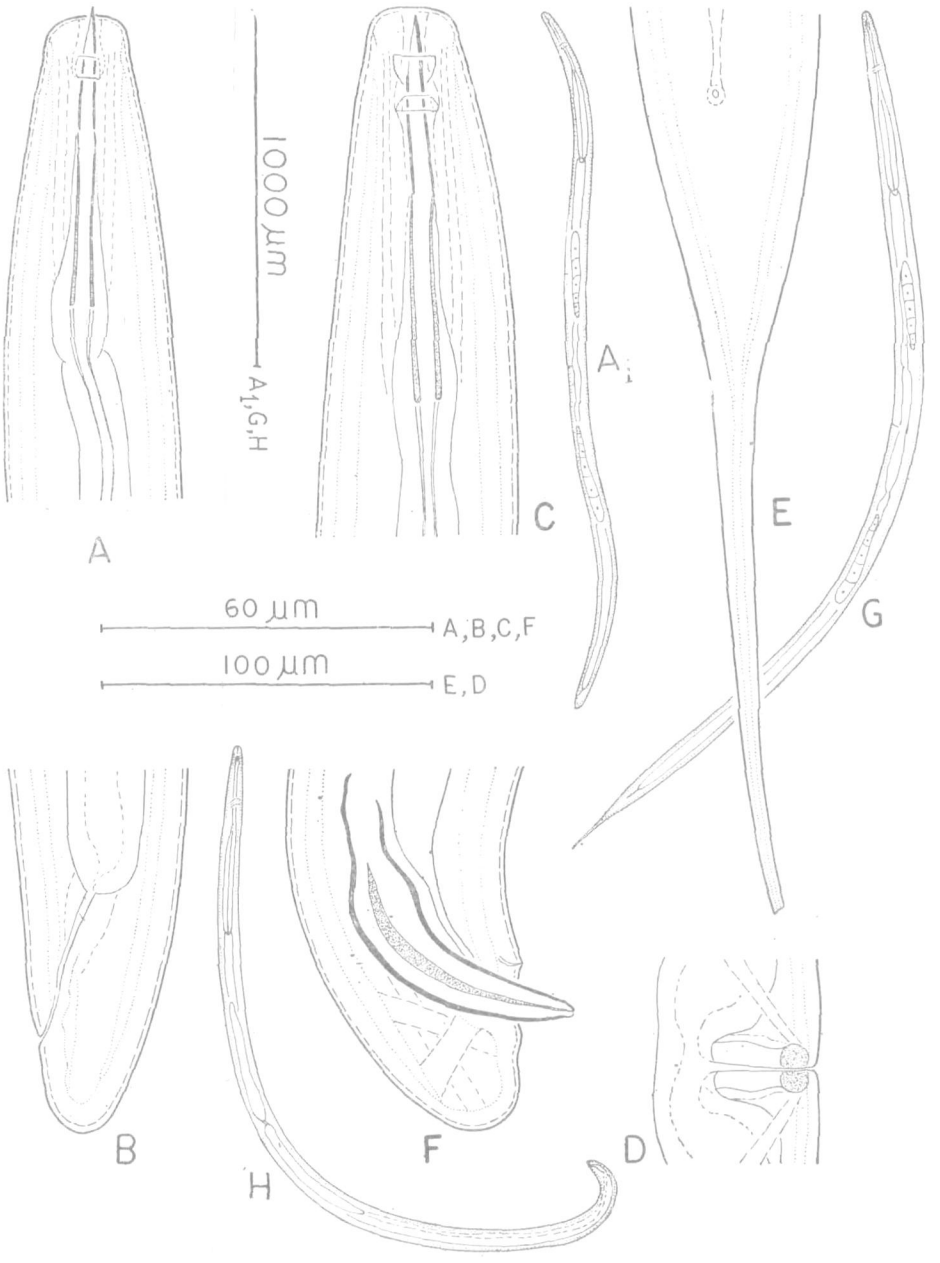

Fig. 3. A_1 & A—B ; *Eudorylaimus odhneri* (Allgen, 1950) Andrassy, 1959, A_1—Entire female, A—Anterior end, B—Female tail. C—H : *Laimydorus kherai* n. sp., C—Anterior end, D—Vulva and Vagina, E—Female tail, F—Male tail, G—Entire female.

appears to be tongue-shaped, but has become distorted due to flattenning of the specimen. Oesophago-intestinal disc present. Prerectum 150 μm or about 3 anal body-widths long. Rectum length could not be measured because of the dorso-ventral position of the nematode.

Vulva a transverse slit. Vagina 30 μm or 45% of the corresponding body-width, with a moderately sclerotized distal region. Uterus and oviduct separated by sphincter, uteri filled with sperms. Ovaries reflexed ; oocytes arranged in a single row, double row and then in multiple rows at the region of growth.

Tail 245 μm long, elongate filiform, tip broken. Caudal pores not seen.

Male : Similar to female in general morphology except for tail shape and male reproductive system. Odontostyle 31 μm or about 2 lip region-widths long. Odontophore 36 μm or about 1.2 times the odontostyle length. Guiding ring 17.5 μm or 1.2 lip region-widths from anterior extremity. Gonads typical. Supplements consist of an adanal pair and a series of 26 contiguous ventromedians. The first ventromedian supplement situated 2.3 anal body-widths from cloacal opening. Subventral papillae not seen. Spicules 65 μm or 2.1 anal body-widths long along curved median line. Lateral guiding pieces present. Tail bluntly rounded, 20 μm or 0.65 anal body-width long. Caudal pores present.

Differential diagnosis : *Laimydorus kherai* n. sp is close to *L. conurus* (Thorne, 1939) Siddiqi, 1969 and *L. baldus* Baqri & Jana, 1982. From the former it differs in having shorter body and odontostyle, more posteriorly situated guiding ring (L = 1.6 mm ; odontostyle and guiding ring = 19 μm and 13 μm respectively as calculated from Thorne, 1939). The male further differs from *L. conurus* in having more ventromedian supplements and longer spicules (ventromedian supplements 21 and spicules 50 μm long). *L. kherai* has longer odontostyle and odontophore, more posteriorly situated guiding ring and longer spicules than *L. baldus* (odontostyle 24-25 μm, odontophore 29-30 μm, guiding ring 14-15 μm, and spicules 53 μm in *L. baldus*).

Type habitat and locality : From the banks of stagnant freshwater tank, Surajkund, Lucknow, U. P.

Type specimens : Collected by Dr. S. Khera in April, 1967. Holotype along with male paratype mounted on slide W 7193/1.

Eudorylaimus odhneri (Allgen, 1950) Andràssy, 1959

(Fig. 3 : A_1, A-B)

Measurements :

Female (1) : L = 2.11 mm ; a = 47 ; b = 5.0 ; c = 125 ; V = $^{18}49.5^{23.5}$.

DESCRIPTION

Body irregularly curved upon fixation, tapering gradually towards both ends. Cuticle 2.5-5 μm thick (thickest on tail), finely transversely striated. Lateral chords about $\frac{1}{3}$rd of body-width near middle. Ventral, dorsal and lateral body pores not seen.

Lip region marked by a slight depression. Odontostyle 23 μm or about 1.5 lip region-widths long, aperture about 8 μm or about 35% of odontostyle length. Guiding ring 12 μm or 0,8 lip region-width from anterior

end. Odontophore 30 μm or about 1.3 times the odontostyle length.

Basal expanded part of oesophagus about 55% of oesophageal length. Oesophageal gland nuclei and their orifices not seen. Cardia short, rounded. Nerve ring 112 μm or about 25% of oesophageal length from anterior end. Prerectum about two anal body-widths long. Rectum 25 μm or 1.4 anal body-widths long.

Vulva a transverse slit. Vagina 22 μm or about half of corresponding body-width. Reproductive system amphidelphic. Uterus and oviduct separated by sphincter.

Tail bluntly rounded, 16.5 μm or 0.9 anal body-width long. Caudal pores not observed.

Habitat and locality : From the banks of stagnant freshwater tank, Surajkund, Lucknow, U. P.

Actinolaimus omercooperi Filipjev, 1931

(Fig. 4, C—E)

Measurements :

Female (1) : L = 2.80 mm ; a = 33 ; b = 5.0 ; c = 12 ; V = 45

DESCRIPTION

Body irregularly curved and tapering gradually towards both extremities. Cuticle 3-4 μm thick (thickest at tail), marked with longitudinal striae. Lateral chords $\frac{1}{4}$th of body-width near middle. Dorsal, ventral and lateral body pores not seen.

Lip region with amalgamated lips, almost continuous with body. Vestibule a sclerotized structure, armed with 4 onchia, denticles absent. Amphids stirrup-shaped, slits 8 μm wide and 12 μm from anterior end. Sensillar pouches 19 μm from amphidial slit. Odontostyle 27 μm or 1.2 lip region-widths long, aperture 11.5 μm or about 43% of the odontostyle length. Guiding ring 18 μm or 0.8 lip region-width from anterior end. Odontophore 33 μm or 1.2 times the odontostyle length. Anterior slender part of oesophagus and ellipsoidal swelling of odontophore region offset by a constriction at their junction. Basal expanded part of oesophagus occupying about 48% of the neck region. Position of the orifices of oesophageal glands as follows : DO = 51.7 ; S_1O_1 = 68 ; S_1O_2 = 72.5 ; S_2O = 6. Oesophageal gland nuclei not observed. Cardia bulntly rounded, enveloped by intestinal tissue. Prerectum 220 μm or about 6 anal body-widths long. Rectum could not be measured.

Vulva pore like. Length and shape of vagina not observed because of dorsoventral position of the specimen. Reproductive system amphidelphic, with all the usual parts.

Tail elongate conoid, 235 μm or 4.7 anal body-widths long.

Male : The reported male specimen not traced.

Remarks : Khera (1970) identified 3 females and 3 males as *Actinolaimus omercooperi* Filipjev, 1931 from Happy Valley, below Taragarh, Ajmer (Rajasthan) and Padakulam pond, Cranganore, district Trichur (Kerala). Only one badly flattened dorsoventrally mounted female on slide W 7194/1 from Ajmer was available for study, and it is correctly identified as *Actinolaimus omercooperi*.

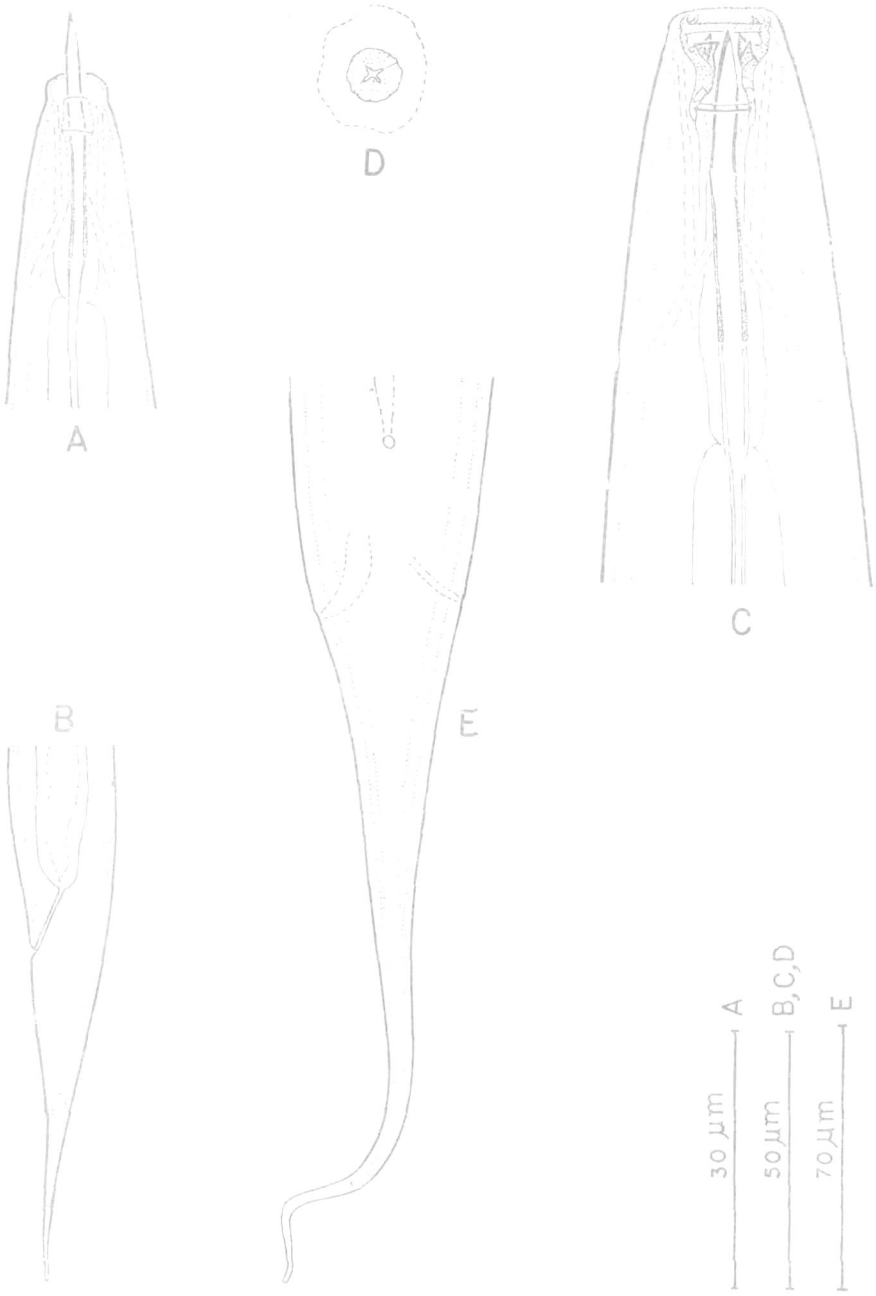

Fig. 4. A—B : *Mesodorylaimus* sp., A– Anterior end, B—Female tail. C—E : *Actinolaimus omercooperi* Filipjev, 1931, C—Anterior end, D—Vulva opening (dorso-ventral position), E—Female tail.

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NEMATODES FROM WEST BENGAL (INDIA) XV. ON THE SPECIES OF SOME RARE GENERA HAVING NARROW ODONTOSTYLE OF THE SUPERFAMILY DORYLAIMOIDEA (DORYLAIMIDA)

By

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ABSTRACT

Lenonchium oryzae Siddiqi, 1965 and *Cephalodorylaimus papillatus* Jairajpuri, 1967 are being reported from Burdwan and 24-Parganas districts respectively. *Kochinema longicaudatum* sp. n. and *Chrysonemoides distinctus* sp. n. are described from Midnapur district (W. Bengal). *Kochinema longicaudatum* sp. n. 0.90-0.97 mm long, has a lip region marked by a constriction, odontostyle 9-10 μm long, odontophore 15-17 μm long, guiding ring about 1/2 lip region-width from anterior end and female tail 12-14 anal body-widths long. *Chrysonemoides distinctus* sp. n. 0.94-1.00 mm long, has a wider lip region than adjoining body, odontostyle 10-11 μm long, odontophore 14-16 μm long, guiding ring about 1/2 lip region-width from anterior end and female tail 6.6-7.1 anal body-widths long.

INTRODUCTION

This fifteenth paper of the series on the nematodes from West Bengal (India) reports two known and two new species of rather rare genera of the superfamily Dorylaimoidea. *Lenonchium oryzae* Siddiqi 1965, the type and only species, is being reported from district Burdwan. *Cephalodorylaimus papillatus* Jairajpuri 1967, also a type and only species, is reported from district 24-Paraganas. *Kochinema longicaudatum* sp. n. and *Chrysonemoides distinctus* sp. n. are being described from around roots of Cashew nut, Midnapur district, West Bengal.

MATERIALS AND METHODS

All the type specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India. *K. longicaudatum* : Holotype female on slide W. N. 493 (a) and four paratype females on slide W. N. 493 (b). *C. distinctus* : Holotype female on slide W. N. 494 (a) and five paratype females on slide W. N. 494 (b).

The specimens were fixed in hot 4% formalin and mounted in anhydrous glycerine.

Lenonchium oryzae Siddiqi, 1965

(Fig. 1, A-D)

Measurements : Female (1) : L = 2.22 mm ; a = 48 ; b = 6.7 ; c = 9.0 ? ; V = $^{15}46^{14}$.

Male (1) : L = 2.18 mm ; a = 52 ; b = 6.2 ; c = 14.6 ; T = 62.

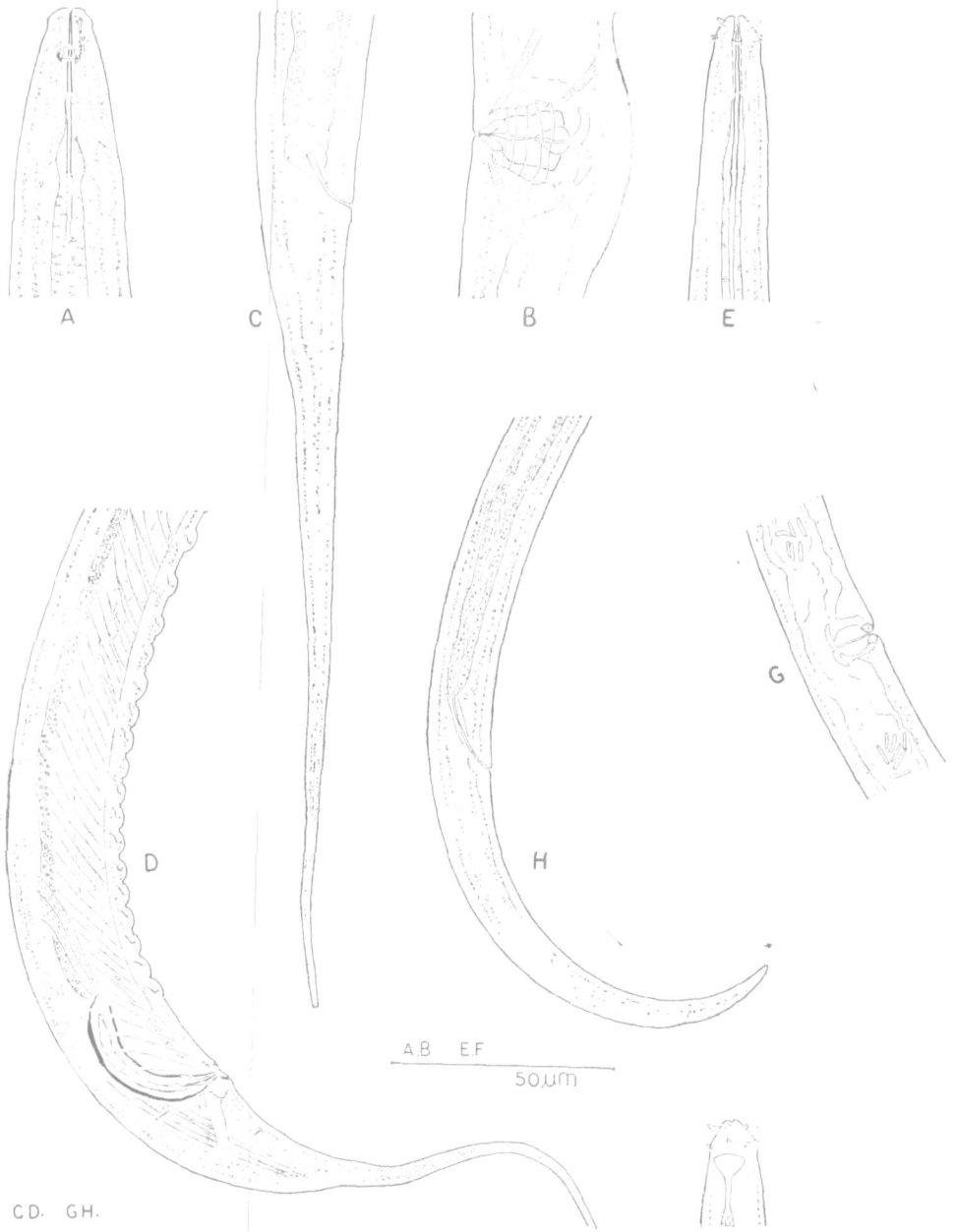

Fig. 1. A—D. *Lenonchium oryzae* Siddiqi, 1965 : A—Anterior end, B—Vulva region, C—Female tail, D—Posterior region of male. E—F. *Cephalodorylaimus papillatus* Jairajpuri, 1967 : E—Antirior end, F—Head end (surface view), G—Vulva region, H—Female tail.

DESCRIPTION

Female : Body slightly ventrally curved. Cuticle loose, finely striated transversely. Lateral chords about $\frac{1}{3}$rd of the corresponding body-width near middle. Lip region marked by a constriction. Amphids stirrup-shaped ; apertures about 6 μm wide. Odontostyle 18-19 μm long. Guiding ring 11-12 μm from anterior end. Odontophore 18-19 μm long. Basal expanded part of oesophagus occupies 55-60% of the neck region. Vulva a transverse slit ; vagina about 22 μm long with two moderately sclerotized pieces at the distal region. Female reproductive system amphidelphic. Prerectum obscure. Tail elongate-filiform, about 4.5 ? (tip broken) anal body-widths long. Caudal pores not seen.

Male : Similar to female in general shape and morphology except the more ventrally curved posterior region and male reproductive system. In addition to an adanal pair, 14 contiguous and the last four slightly spaced ventromedian suppliments present. Spicules 56 μm in length along the curved median line. Lateral guiding pieces 12 μm long. Prerectum about four anal body-widths long. Tail elongate-filiform with a rounded terminus, about 5 anal body-widths long, with one caudal pore on each side.

Habitat and locality : Soil around roots of paddy, *Oryza sativa* L. at Panchra, district Burdwan.

Cephalodorylaimus papillatus Jairajpuri, 1967

(Fig. 1, E-H)

Measurements : Female (1) : L – 1.33 mm ; a = 50 ; b = 4.8 ; c = 9.3 ; V = $^{12}47^{13}$.

DESCRIPTION

Female : Body tapering towards both ends and ventrally more curved in posterior region. Cuticle marked by very fine striations. Lateral chords about $\frac{1}{4}$th of body-width near middle. Lip region amalgamated, elevated, and slightly offset from body. Amphids stirrup-shaped, apertures more than 7 μm wide. Odontostyle thin, 16 μm long. Guiding ring about 6 μm from anterior end. Odontophore cuticularised, 17 μm long. Basal expanded part of oesophagus occupies about 44% of the neck region. Vulva transverse ; vagina 15 μm long with sclerotized distal region. Female reproductive system amphidelphic, typical. Sperms present in the uteri, elliptical, 5-7 μm long. Prerectum about four anal body-widths long. Tail ventrally arcuate, elongate-conoid, about 8 anal body-widths long. Caudal pores not visible.

Habitat and locality : Soil around roots of coconut, *Cocos nucifera* at Lakshipur, district 24-Parganas.

Kochinema longicaudatum sp. n.

(Fig. 2)

Measurements : Female (Holotype) : L = 0.95 mm ; a = 43 ; b = 4.6 ; c = 5.5 ; V = $7.7_{43}7.0$

4 ♀ ♀ (Paratypes) : L = 0.90-0.97 mm ; a = 39-44 ; b = 4.1-4.6 ; c = 5.1-5.5 ; V = $6.7\text{-}7.7_{42\text{-}44}7.0\text{-}7.9$.

DESCRIPTION

Female : Body ventrally curved upon fixation and gradually tapering towards both

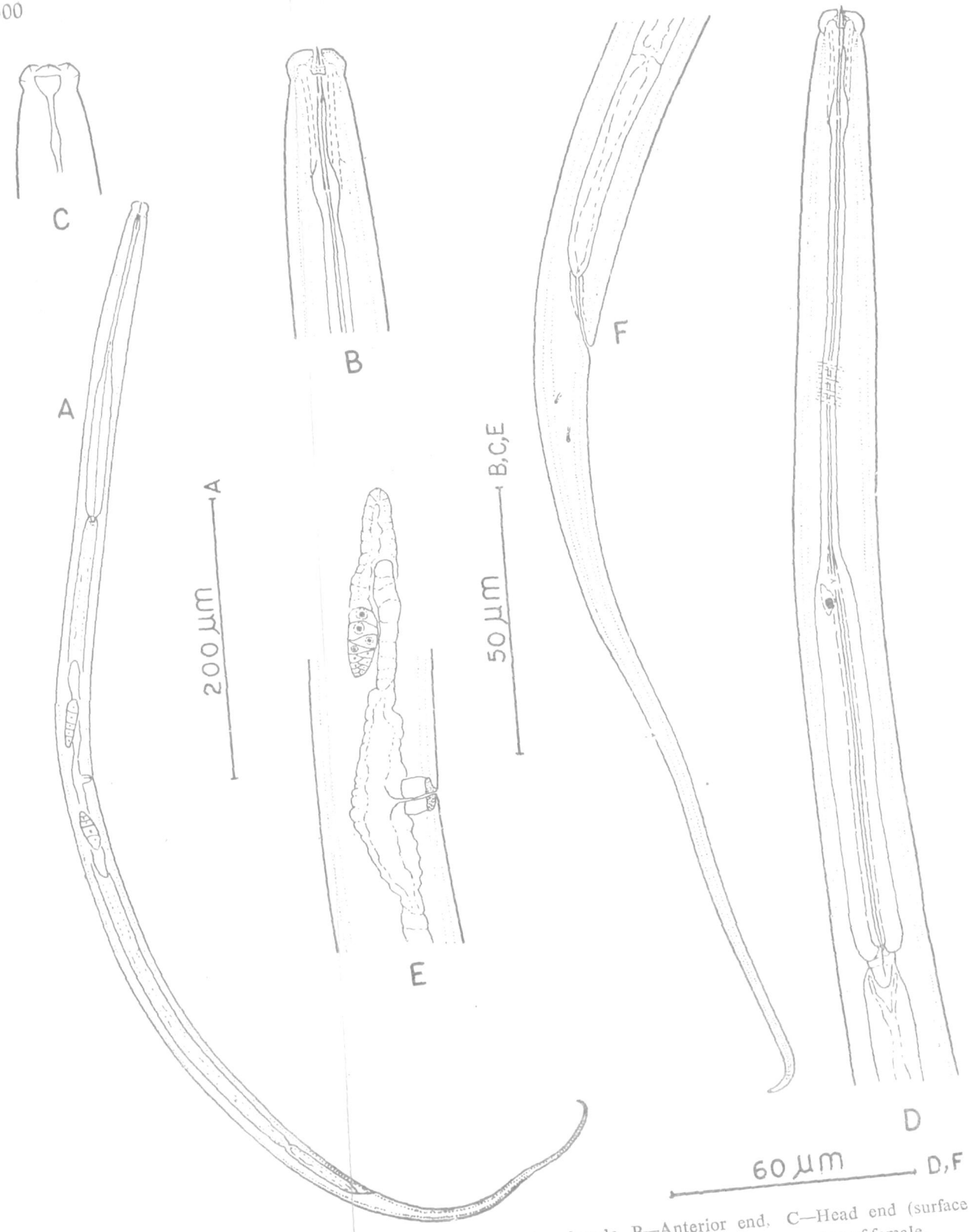

Fig. 2. *Kochinema longicaudatum* sp. n.: A—Entire female, B—Anterior end, C—Head end (surface view), D—oesophgeal region, E—Anterior sexual branch, F—Posterior region of female.

ends. Cuticle transversely striated ; its thickness 2-3 μm (thickest at tail). Lateral chords granular, 1/2.3-1/2.1 of the body-width near middle. Dorsal, ventral and lateral body pores indistinct.

Lip region offset by a constriction, wider than adjoining body, and about half of the body-width at base of oesophagus. Amphids typically labial in position, stirrup-shaped ; apertures 5-6 μm wide or about half of the corresponding body-width and about 2 μm from anterior end. Sensillar pouches 12-13 μm from amphidial slits.

Odontostyle 9-10 μm or 1.2-1.3 head-width long ; aperture 4.0-4.5 μm or 44-46% of the odontostyle length. Guiding ring 5 μm or about 1/2 lip region-width from anterior end. Odontophore simple rod-like, 15-17 μm or 1.6-1.7 times the odontostyle length. Basal expanded part of oesophagus occupies 44-46% of the neck region. Locations of the oesophageal gland nuclei and their orifices obscure.

Nerve ring at 70-77 μm or 31-36% of the neck region from anterior end. Cardia tongue-shaped, 7-9 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 42-55 μm or 3-4 anal body-widths long. Rectum 17-21 μm or 1.2-1.5 anal body-width long.

Vulva a transverse slit. Vagina 7-9 μm, extending 35-40% of the corresponding body-width, sclerotized distally. Female reproductive system amphidelphic. Uterus and oviduct not distinctly separated. Ovaries reflexed ; oocytes arranged in a single row except the region of multiplication.

Tail filiform with rounded terminus, 167-188 μm or 12-14 anal body-widihs long, with 2-3 caudal pores on each side.

Male : Not found.

Differential diagnosis : *Kochinema longicaudatum* sp. n. differs from the only existing species *K. proamphidium* Heyns, 1963 in having shorter odontostyle, unequal length of odontostyle and odontophore, anteriorly situated vulva, and filiform tail (odontostyle twice the width of lip region, odontostyle and odontophore equal in length, V = 56-59 and tail convex-conoid in *K. proamphidium*).

Remarks : Darekar and Khan (1979) proposed the genus *Indokochinema* and distinguished it from *Kochinema* Heyns, 1963 in having the following characters : Shorter odontostyle with wider lumen, monoopisthodelphic reproductive system and sclerotized vulva-vagina junction (odontostyle 2 head-widths long, didelphic reproductive system and vulva-vagina junction not sclerotized in *Kochinema*). Interestingly, the present new species, *K. longicaudatum*, shares the characters of both the genera, i.e., slender odontostyle and didelphic reproductive system like *Kochinema* while shorter odontostyle length and sclerotized vulva-vagina junction like *Indokochinema*. However, we prefer to place the new species under *Kochinema* because of slender odontostyle and didelphic reproductive system.

Type habitat and locality : Soil around roots of cashew nut, *Anacardium occidentale* L., at Hinari, block Ramnagar, district Midnapur, W. Bengal.

Chrysonemoides distinctus sp. n.

(Fig. 3)

Measurements :

Female (Holotype) ; L = 0.96 mm ; a = 48 ; b = 4.1 ; c = 11 ; V = $^{10.3}_{49.5}{}^{7.7}$

5 ♀ ♀ (Paratypes) : L = 0.94-1.00 mm ; a = 48-54, b = 4.1-4.2 ; c = 11.0-11.6 ; V = $^{7.9\text{-}9.3}_{46\text{-}49}{}^{6.7\text{-}9.9}$.

DESCRIPTION

Female : Body ventrally curved upon fixation and tapering gradually towards both ends. Cuticle finely striated tranversely ; its thickness 1-2 μm thick (thickest at tail). Lateral chords 1/2.6-1/2.4 body-width near middle. Dorsal, ventral and lateral body pores inconspicuous. Lip region wider than adjoining body, 1/1.6-1/1.4 body-width at base of oesophagus. Amphids stirrup-shaped ; apertures 4-5 μm wide or 36-40% of the corresponding body-width and about 5 μm from anterior end. Sensillar pouches 13-14 μm from amphidial slits.

Odontostyle 10-11 μm or 0.8-1.0 head-width long ; aperture about 2.5 μm or 22-25% of the odontostyle length. Guiding ring 5-6 μm or about 1/2 lip region-width from anterior end. Odontophore rod-like, 14-16 μm or 1.4-1.6 times the odontostyle. Basal expanded part of oesophagus occupies 45-48% of the neck region. Locations of oesophageal gland nuclei and their orifices are not clearly visible, except in a single specimen (Fig. 3, D) which are as follows :

DO = 58.8	S_1N = 72.6	S_2N = 85.9
DN = 62.8		S_2O = 87.8
DO–DN = 4.0		

Nerve ring at 84-92 μm or 35-39% of the neck region from anterior end. Cardia tongue-shaped, 6-8 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 50-65 μm or 4-5 anal body-widths long. Rectum 14-17 μm 1.0-1.3 anal body-width long.

Vulva a transverse slit. Vagina 8-10 μm long, extending 45-55% of the corresponding body-width and sclerotized distally. Female reproductive system amphidelphic. Uterus and oviduct are not distinctly separated. Ovaries reflexed ; oocytes arranged in a single row except in the region of multiplication.

Tail ventrally curved, elongate-conoid with rounded terminus, 84-88 μm or 6.6-7.1 anal body-widths long, with 2-3 caudal pores on each side.

Male : Not found.

Differential diagnosis : *Chrysonemoides distinctus* sp. n. comes close to *C. holsaticus* (Schneider, 1925) and *C. limigenus* Siddiqi, 1970. From the former the present new species differs in having shorter body length and differently shaped lip region (L = 1.3-2.6 mm ; lip region distinctly offset from the body with angular lips in *C. holsaticus*). From *C. limigenus* it differs in having shorter body length, odontostyle and odontophore (L = 2.4-3.0 mm ; odontostyle = 13-14 μm and odontophore = 23-25 μm long in *C. limigenus*).

Type habitat and locality : Soil around roots of cashew nut, *Anacardium occidentale*, from Hinari, Block Ramnagar, district Midnapur, W. Bengal.

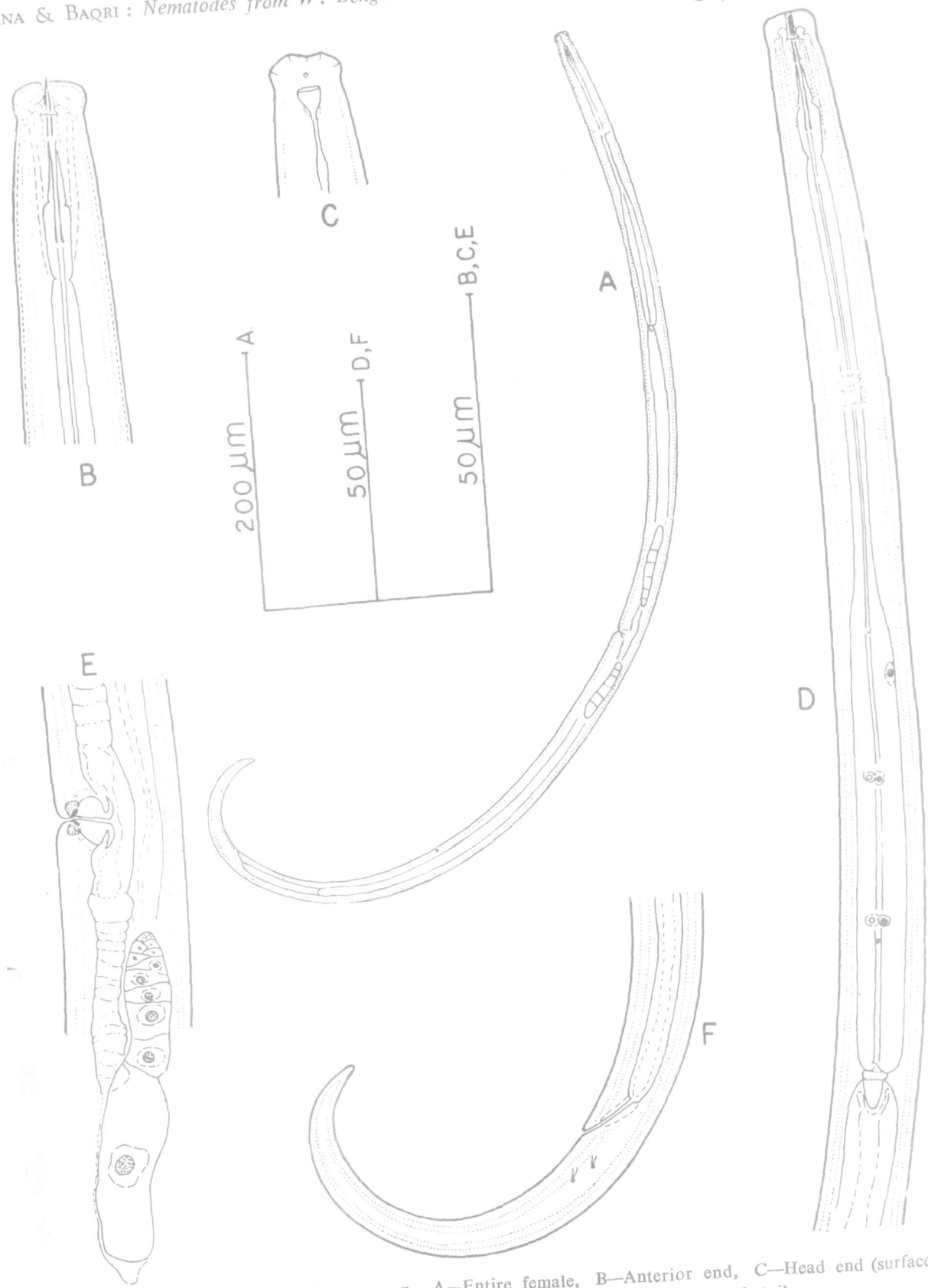

Fig. 3. *Chrysonemoides distinctus* sp. n. A—Entire female, B—Anterior end, C—Head end (surface view), D—Oesophageal region, E—Posterior sexual branch, F—Female tail.

ACKNOWLEDGEMENT

We are thankful to Dr. B. K. Tikader, Director of Zoological Survey of India, Calcutta, for providing research facilities.

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Indian J. Helminth. (n. s.), Vol. 3, (No. 2), Dec., 1986, 11–20

NEMATODES FROM WEST BENGAL (INDIA), IX. THREE NEW SPECIES OF THE SUPERFAMILY DORYLAIMOIDEA (DE MAN, 1876) THORNE, 1934

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ABSTRACT

Three new species of the superfamily Dorylaimoidea have been described from West Bengal, viz., *Dorylaimus geraerti* sp. n., *Ischiodorylaimus novus* sp. n., and *Thornenema elaboratum* sp. n. *Dorylaimus geraert* i sp. n. 2.83-3.49 mm long, has 32-34 longitudinal lines on the surface of cuticle, lip region marked by a depression, odontostyle 43-47 μm, odontophore 40-43 μm, female tail 6-11 anal body-widths long with a posterior end bent dorsally ; male tail bluntly rounded, and spicules 81-84 μm long. *Ischiodorylaimus novus* sp. n. 4.12-4.48 mm long, has 28 longitudinal lines on the surface of cuticle, lip region marked by a slight depression, odontostyle 54-64 μm, odontophore 63-65 μm, female tail 3.6 anal body-widths long ; male with distinct two groups of ventromedian supplements (20 in first group, 14 in second group and five irregularly spaced are arranged in between the two groups), and spicules 120 μm long. *Thornenema elaboratum* sp. n, 1.21—1.31 mm long, has slightly truncated lip region with sclerotized cheilostome, odontostyle 17-19 μm, odontophore 22-24 μm, anterior uterine sac absent, tail set off from body on both the sides before the elogate part is being drawn, 3.3—3.7 anal body-widths long, and vagina with two heavily sclerotized pieces placed in the middle of moderately sclerotized ring.

INTRODUCTION

The present paper, ninth of the series on "Nematodes from West Bengal (India)', describes three new species of the superfamily Dorylaimoidea (de Man, 1876), viz., *Dorylaimus geraert* i sp. n., *Ischiodorylaimus novus* sp. n., and *Thornenema elaboratum* sp. n.

MATERIALS AND METHODS

The nematodes were fixed in hot 4% formalin, dehydrated in the descicator and mounted in anhydrous glycerine. The specimens have been deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

Dorylaimus geraerti*sp. n.

(Fig. 1)

Measurements :

Holotype female : L=3.15 mm ; a=32 ; b=4.6 ; c=13 ; v=$^{11}41^{11}$.

Paratype females (3) : L=2.83—3.49 mm ; a=33—39 ; b=4.3—4.7 ; c=12—13 ; v=$^{13-16}41$—43^{13-17}.

Paratype males (3) : L=2.52—2.90 mm ; a=32—33 ; b=3.8—4.4 ; c=68—83 ; T=62—72.

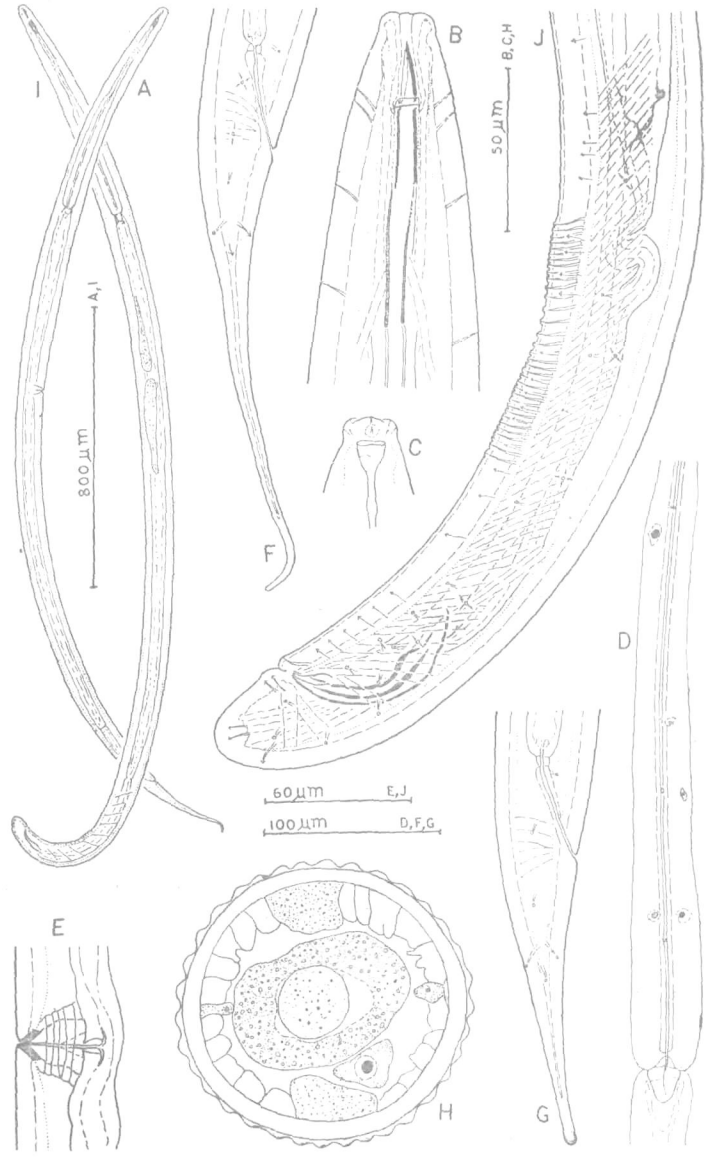

Fig. 1 – *Dorylaimus geraerti* sp. n. A-Entire female, B-Anterior end of female, C-Surface view of anterior end, D-Basal expanded part of oesophagus, E—Vulva-vagina junction, F-Female tail, G-Female tail, (abnormal), H-Cross section through mid-body, I-Entire male, J-Posterior region of male.

DESCRIPTION

Female : Body ventrally curved in posterior half upon fixation, tapering gradually towards both extremities. Cuticle finely striated transversely, marked with 32—34 longitudinal lines on the surface, its thickness 5 - 8 μm at mid-body and 9—12 μm at tail. Dorsal and ventral body pores 6—11 and 9—15 respectively. Lateral body pores 52-72, irregularly spaced, distributed along both sides of lateral chords.

Lip region slightly marked by a depression ; 1/4.5—1/5.7 of body-width at base of oesophagus. Amphids stirrup-shaped, apertures 9—11 μm or 50—58% of the corresponding-body-width and 7—8 μm from anterior extremity. Sensillar pouches 20—23 μm from amphidial apertures.

Odontostyle 43—47 μm or 2.4—2.6 lip region-width long, 4—6 μm thick ; aperture 19—22 μm or 40—46% of odontostyle length. Guiding ring 26—29 μm or 1.5—1.7 lip region-width from anterior extremity. Odontophore 40—43 μm or about 0.9 1.0 time the odontostyle length. The basal expanded part of oesophagus occupying 50—54% of the neck region. Locations of oesophageal gland nuclei and their orifices as follows :

DO=50.8—53.1	S_1N_1=70—71	S_2N=85 89
DN=52.5—55.4	S_1N_2=76—77	S_2O=86 - 90

DO - DN =1.4—2.3

K=69—74 K' = 72—76

Nerve ring 190—202 μm or 28 - 29% of neck region from anterior end. Cardia conoid with rounded tip, enveloped by intestinal tissue. Prerectum 196—241 μm or 4.7 5.3 anal body-widths long. Rectum 52-57 μm or 1.2—1.4 anal body-widths long.

Vulva a transverse slit. Vagina extending inward 37—46 μm or 1/1.8 -1/2.4 of the corresponding body-width, with sclerotized distal region. Reproductive system amphidelphic. Uterus and oviduct separated by well developed sphincter ; oocytes arranged in a single row except at growth region.

Tail elongate conoid, posterior end bent dorsally with rounded terminus, 249 - 406 μm or 6—11 times anal body-width long (except in one female where the abnormal tail measures 163 μm or 3.5 times the anal body-width long) with three to four caudal pores on each side.

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* Named after Prof. E. Geraert, Associate Editor of Nematologica, Instituut voor Dierkude, 35-Ledeganckstraat, Gent, Belgium

Male : Male genital system typical. Spicules 81-84 μm or 1.8 - 1.9 anal body-widths long. Lateral guiding pieces 14 – 16 μm long. The supplements consist of an adanal pair and 35-38 ventromedian, arranged almost contiguously except 4 – 5 slightly spaced near the middle of the series. Subventral papillae 24 – 25, irregularly spaced, extend beyond the supplement region. Prerectum 213-322 μm or 4.8 – 7.1 anal body-widths long.

Tail bluntly rounded, 35-37 μm or 0.7—0.8 anal body-width long, with 6—7 caudal pores on each side.

Type habitat and locality : From soil around roots of Brinjal, *Solanum melongena* L., from Narendrapur, district 24 Paraganas.

Type specimens : Holotype female with a paratype male mounted on slide No. WN 443 and other paratypes on slide No. W.N. 444 and 445.

Differential diagnosis : *Dorylaimus geraerti* sp. n. comes close to *D. thornei* Andrassy, 1969 and *D. carinatus* Thorne et Swanger, 1936. From the former it differs in having differently shaped lip region (lip region marked by a deep constriction with slightly sub-angular lips in *D. thornei*), cuticle thicker than odontostyle (cuticle as thick as odontostyle in *D thornei*), longer odntostyle (2.4 2 6 lip region-width against 1.8 in *D thornei*) and differently shaped amphids. From *D. carinatus* it differs in having differently shaped lip region and amphids (lip region continuous in *D. carinatus*). The male differs in having differently shaped tail, lesser number and well developed ventromedian supplements (supplements slightly marked, 35-38 against 55 in *D. carinatus*).

The present new species is district from other species of *Dorylaimus* in having different arrangement of ventramedian supplements.

Remarks : The presence of 4-5 slightly spaced ventromedian supplements near the middle of the series shows the relationship of the present new species with the genus *Ichiodorylaimus* Andrassy, 1969. However, it comes closer to the species of the genus *Dorylaimus* because of the following characters : The body is shorter and the ventromedian supplements are not arranged in two distinct groups.

Ischiodorylaimus novus sp. n.

(Fig. 2)

Measurements :

Holotype female : L=4.48 mm ; a = 35 ; b = 4.7 ; c=19 ; v=$^{15}43^{17}$.

Paratype male : L=4.12 mm ; a=31 ; b=4.3 ; c = 88 ; T=64.

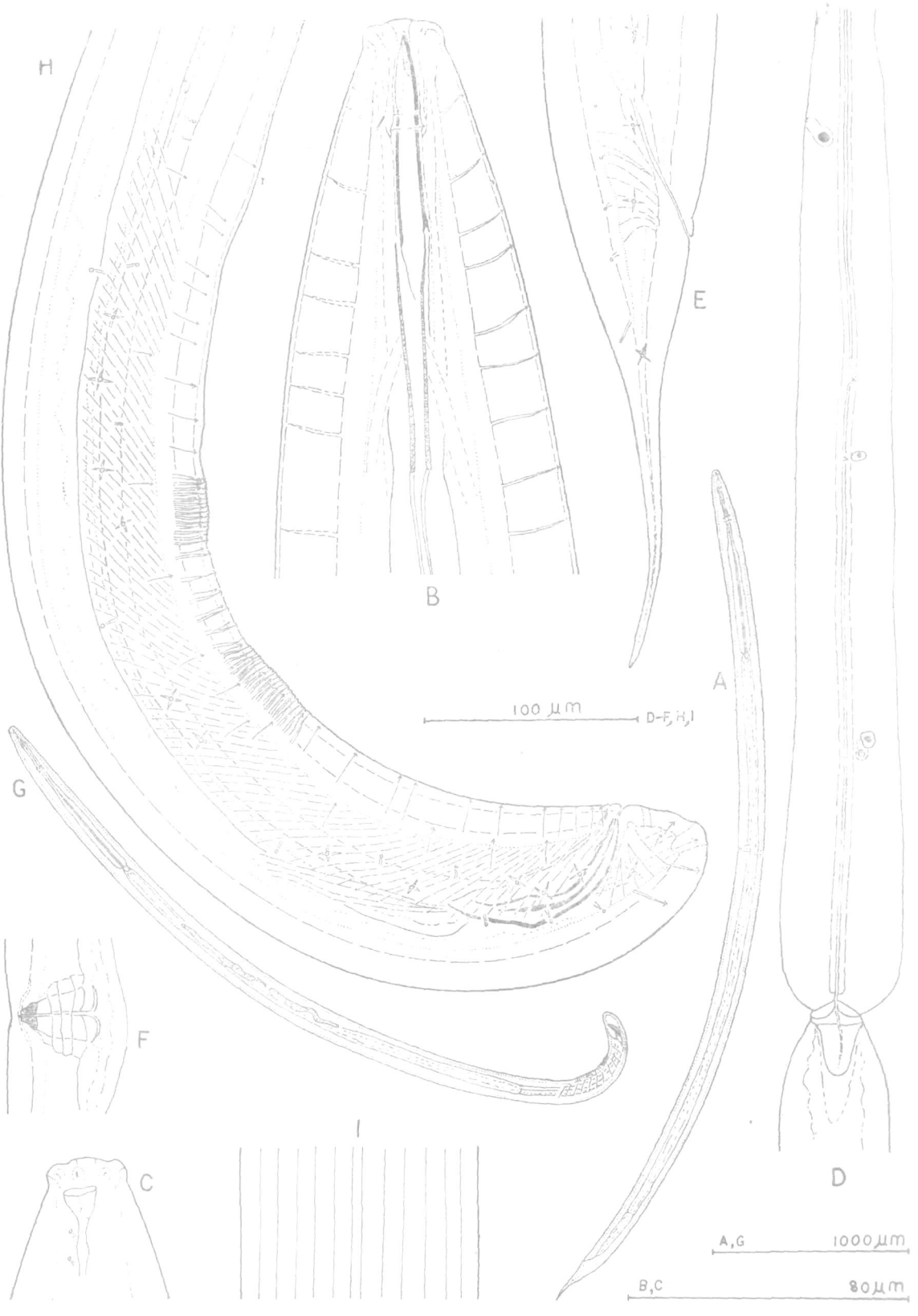

Fig. 2. *Ischiodorylaimus novus* sp. n.

A-Entire female, B-Anterior end, C-Surface view of anterior end, D-Basal expanded part of oesophagus, E-Female tail, F-Vulva-vagina junction, G-Entire male, H-Posterior region of male, I-Longitudinal lines in the cuticle at mid-body.

Description :

Female : Body ventrally curved in posterior half upon fixation, tapering gradually towards both extremities. Cuticle finely striated transversely, marked with 28 longitudinal lines, its thickness 12—13 μm at mid-body and 15—17 μm at tail. Lateral chords about 1/6th of body-width near middle. Ventral body pores 54, of which 27 in oesophageal region and the rest up to the middle of posterior gonad region. Lateral body pores 133, arranged irregularly along both sides of lateral chords, of which 55 in the oesophageal region, 22 between cardia and vulva region, 56 between vulva and anus region.

Lip region marked with slight depression, 1/5.7—1/6.5 of body-width at base of oesophagus. Amphids stirrup-shaped, aperture 5 μm from anterior extremity and occupying 11-12 μm or about 46—50% of the corresponding body-width. Sensillar pouches 17—19 μm from amphidial aperture.

Odontostyle 54—60 μm or 2.3—2.6 lip region-width long ; thickness about 6—8 μm aperture ; aperture 40—42% of the odontostyle length. Guiding ring 31 μm or 1.3—1.4 lip region-width from anterior extremity. Odontophore 63—65 μm or about 1.1 times the odontostyle length. Basal expanded part of oesophagus occupies 54% of the neck region. Locations of oesophageal gland nuclei and their orifices as follows :

DO = 48.5	$S_1^1N_1^1$ = 65	S_2N = 85
DN = 50.9	$S_1^1N_2$ = 69	S_2O = 85
DO − DN = 2.4		
	K = 75	K' = 90

Nerve ring 245—253 μm or 26—27% of the neck region from anterior extremity. Cardia tongue-shaped, 28—29 μm long, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 296 μm or 4.6 anal body-widths long. Rectum 80 μm or 1.2 anal body-width long.

Vulva a transverse slit. Vagina extending inward 47 μm or about 1/3rd of the corresponding body-width, with moderately sclerotized distal region. Reproductive system amphidelphic. Uterus and oviduct separated by sphincter ; oocytes arranged first in a single row and then in double row and multiple rows in gorwth region.

Tail elongate conoid with subacute terminus, 235 μm or 3.6 anal body-width long, with three caudal pores on each side.

Male : Male genital system typical. Spicules 120 μm or 1.8 anal body-width long medially. Lateral guiding pieces well developed, 1.5 μm long. The supplements consist of an adanal pair and 39 ventromedians. The ventromedian supplements are arranged in distinct two groups, 20 in first group and 14 in second group, and five irregularly spaced are arranged in between the two groups. The first group of supplements starts at about 2.5 anal body-width from cloacal opening. Subventral papillae 40, spaced irregularly Copulatory muscles in 73 bands and extend beyond the supplement region. Prerectum 710 μm or about 11 anal body-widths long.

Tail short and bluntly rounded, 47 μm or 0.67 anal body-width long, with seven caudal pores on each side.

Type habitat and locality : From soil around roots of paddy, *Oryza sativa* from Saldah, block Memari, district Burdwan.

Type specimens : Holotype female along with paratype male mounted on slide No. WN 446.

Differential diagnosis : *Ischiodorylaimus novus* sp. n. come close to *I. ugandanus* Andrassy et Banage, 1969 in Andrassy, 1969 but differs from it in having less number of cuticlar lines (longitudinal lines 28 against 32 in *I. ugandanus*), thinner odontostyle (odontostyle 6 – 8 μm thick against 10 – 11 μm in *I. ugandanus*), anteriorly situated guiding ring (guiding ring 1.3 – 1.4 lip region-width against 1.6 lip region-width in *I. ugandanus*), and differently shaped amphids ; the male differs in having differently shaped spicules and tail, more number and different arrangement of ventromedian supplements and sub-ventral papillae.

Thornenema elaboratum sp. n.
(Fig. 3)

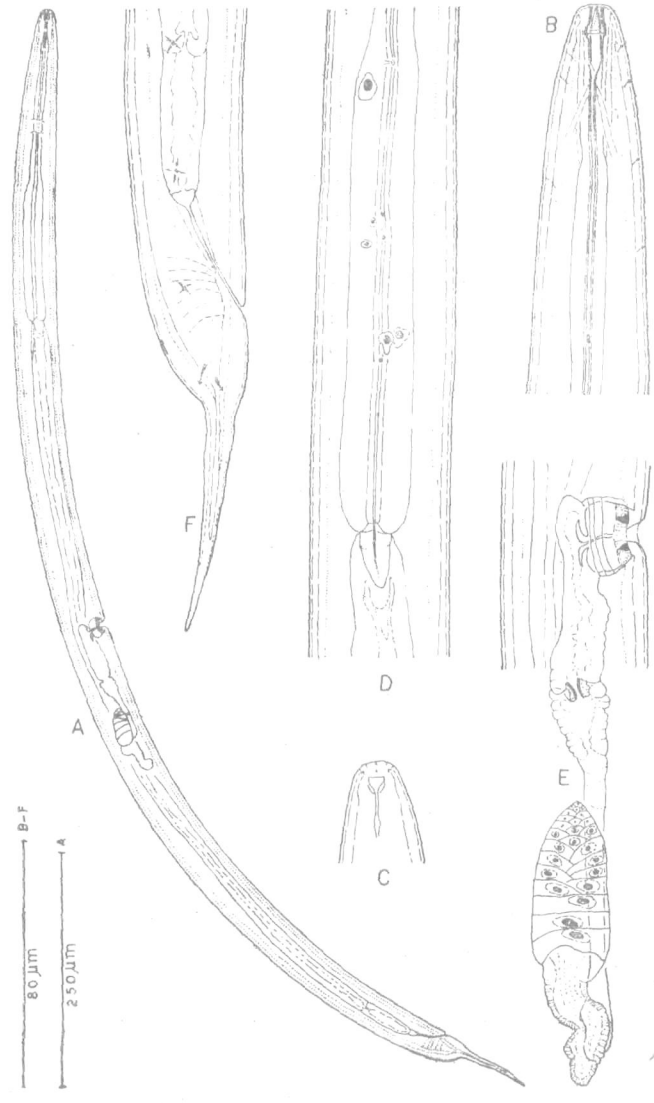

Fig.—3. *Thornenema elaboratum* sp n. **A**-Entire female, **B**-Anterior end of female, **C**-Surface view of anterior end, **D**-Bsal expanded part of oesophagus, **E**-Female reproductive system, **F**-Posterior region of female.

Measurements :

Holotype female : L=1.34 mm ; a=31 ; b=4.1 ; c=13 ; v=48[12].

Paratype females (5 : L = 1.21 −1.40 mm ; a = 30−32 ; b = 3.8−4.3 ; c=13 − 14 ; v=48 - 51[10-16].

Description :

Female : Body slightly ventrally curved upon fixation, tapering towards both extremities. Cuticle finely striated transversely, its thickness 2 3 μm at mid-body and 6 μm at tail. Lateral chords granular, 1/5.5—1/4.4 of the body-width near middle. Only 8—10 lateral body pores visible in oesophageal region.

Lip region slightly truncated, continuous, with sclerotized cheilostome, 1/3.5—1/3.2 of body-width at base of oesophagus. Amphids stirrup-shaped, about 5 μm from anterior extremity and apertures occupy 5 - 6 μm or 36—42% of the corresponding body-width. Sensillar pouches 15—16 μm from amphidial apertures.

Odontostyle 17—19 μm or 1.3—1.5 lip region-width long, its lumen about 4 μm thick ; aperture about 7 μm or 37—42% of the odontostyle length. Guiding ring 9 10 μm or about 0.8 lip region-width from anterior extremity. Odontophore 22—24 μm or 1.1—1.3 times the odontostyle length. Endolids distinctly present at about 30—32% of the oesophageal length from anterior end. The basal expanded portion of oesophagus occupying 45—48% of the neck region. Locations of oesophageal gland nuclei and their orifices as follows :

DO=55.7—58.2	S_1N_1=68—72	S_2N=82—83
DN=58 3—61.2	S_1N_2 = 70 —72	S_2O=84 - 85

DO—DN=2.5—3.3

K = 80—83 K'83 - 86

Nerve ring at 120—124 μm or 37 - 39% of neck region from anterior extremity. Cardia tongue-shaped, 14—18 μm long, enveloped by intestinal tissue. Prerectum 48-60 μm or 1 5—2 2 anal body-width long Rectum 28 - 36 μm or 1 0—1.2 anal body-width long

Vulva situated in a depression, pore like. Vagina extending inward 18—20 μm or 1/2.2—1/2.5 of the corresponding body-width, distally sclerotized with two heavily sclerotized pieces placed in the middle of moderately sclerotized ring Female reproductive system mono-opisthodelphic. Anterior uterine sac absent Uterus and oviduct separated by a well developed sphincter ; oocytes arranged in a single row except at the region of multiplication

Tail elongate-conoid, slightly set off from body on both sides before the tail is being drawn, 88—108 μm or 3.3 - 3.7 anal body-width long, with two caudal pores on each side.

Male : Not found.

Type habitat and locality : Soil around roots of Banana, *Musa* sp , at Tung-Sung, district Darjeeling.

Type specimens : Holotype female along with 5 paratype females mounted on slide No. WN 447.

Differential diagnosis : *Thornenema elaboraium* sp. n comes close to *T. laevicapitatum* (Cobb in Thorne & Swanger, 1936) Andrassy, 1959 and *T. cavalcantii* (Lordello, 1955) Andrassy, 1959. From the former it differs in having smaller odontostyle (odontostyle about 2 lip region-width in *T. laevicaptatum*), differently shaped lip region (truncated against rounded conical in *T laevicapitatum*) and longer prerectum (prerectum one and one third of the anal diameter in *T laevicaptatum*) From *T. cavalcantii* it differs in having longer body (L=0 9 1 1mm in T. cavalcantii), longer odontostyle (odontostyle 11 13 μm in *T cavalcantii*), differently shaped vulva-vagina with two heavily sclerotized pieces, anterior uterine sac absent, and differently shaped tail

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Title : Halalaimus sagarensis n. sp. (Nematoda : Oxystominidae) from Mangrove Environment of Sunderbans, West Bengal

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ABSTRACT

During the survey of intertidal freeliving nematodes from the mangrove environment of deltaic Sunderbands, West Bengal, a nematode of the family Oxystominidae was collected which seems to be new to science. The worm inhabiting the intertidal mud-flat has been described in detail with its morphometric measurements and compared with related species of the genus.

INTRODUCTION

Although freeliving nematodes inhabiting the intertidal mud or sand flats constitute the major meiofaunal component of every shallow marine habitat, a fact that is regrettable that this dominating group from the Indian coasts is poorly known. So, the present authors are fortunate to study the taxonomy of the benthic nematodes of deltaic Sunderbans which is marked as an important spot on the global map for its luxuriant mangrove vegetation and which also supports a large number of estuarine fauna in the form of plankton, nekton and benthos. The description of a new species is hereby presented in this communication.

MATERIALS AND METHOD

Nematode specimens were extracted from mangrove litter soil by following the modified Baerman Funnel method and were fixed in 4% hot formalin and then mounted in anhydrous glycerin

SYSTEMATIC ACCOUNT

Class	:	Nematoda
Subclass	:	Enoplia
Order	:	Enoplida
Suborder	:	Tripylina
Sup. Family	:	Oxystominoidea
Family	:	Oxystominidae
Genus	:	*Halalaimus*
Species	:	*H. sagarensis* n.sp.

DESCRIPTION

Measurements: ♀ (Holotype): L = 1.4 mm; a = 50; b = 4.5; c = 5; c' = 17.5; V = 45.5

♂ (Allotype): L = 1.2 mm; a = 58; b = 4.5; c = 4.5; c' = 15.5; T = 55.

Paratypes: Measurements are given in the Table 1.

Female: Body almost straight upon fixation, tapering considerably towards both ends. Cuticle smooth, 2-2.5 µm thick without lateral lines. Head with labial papillae and 6 labial setae of 3.5-4 µm

behind the anterior extremity, arranged in single row. Head with about 1/5th of the body-width at the oesophageal base. Amphids 1.5-1.7 µm wide and 21-24 µm from the anterior end of the body. Amphidial duct indistinct. Somatic, caudal and terminal setae absent.

Stoma very long leading to the pharynx. Oesophagus wider posteriorly, with two oesophageal gland nuclei near the base of the oesophagus; their outlets inconspicuous. Excretory pore and renette cell not observed. Oesophago-intestinal junction is enclosed by intestinal tissue. Intestine with wide lumen; rectum 26-28 µm or less than two anal body-widths long. Nerve ring at about 50-55% of the oesophageal length from anterior end of body.

Female reproductive system amphidelphic with reflexed ovaries. Posterior sexual branch slightly longer than the anterior one. Both uterine branches having well developed spermatheca, filled with sperms. Vagina 1/3rd of the corresponding body-width, sclerotized distally. Vulva a transverse slit.

Tail long, filiform, 280 µm long or 18 anal body-widths long, with rounded terminus. Three caudal glands present. Spinneret could not be observed.

Male: Same as female except the reproductive organs. Testis outstretched. Spicules 28 µm long. Gubernaculum 10 µm long

with lateral guiding pieces, Tail long, filiform, 18 anal body-widths long.

HABITAT

Midlittoral region, habitat exposed, salinity 14.06‰ (intertidal water) pH = 7.9. Specimens collected from litter soil around roots of Phoenix sp.

TYPE LOCALITY

Ganga Sagar, zone between highest high tide level and low tide level.

DIFFERENTIAL DIAGNOSIS

The present species comes close to Halalaimus mayersi Wieser and Hopper, 1967 in having pre-equitorial vulva, same position of amphids, amphidelphic female reproductive system and gubernaculum with lateral guiding pieces. However, it differs in having shorter body length (L = 2.2-2.4 mm vs L = 1.2-1.4 mm), shorter and different arrangement of cephalic setae (3.4-4 µm vs 20 µm long setae and single row in present species vs double circle), shorter and differently shaped amphids and in the absence of excretory system.

ACKNOWLEDGEMENTS

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LEGENDS

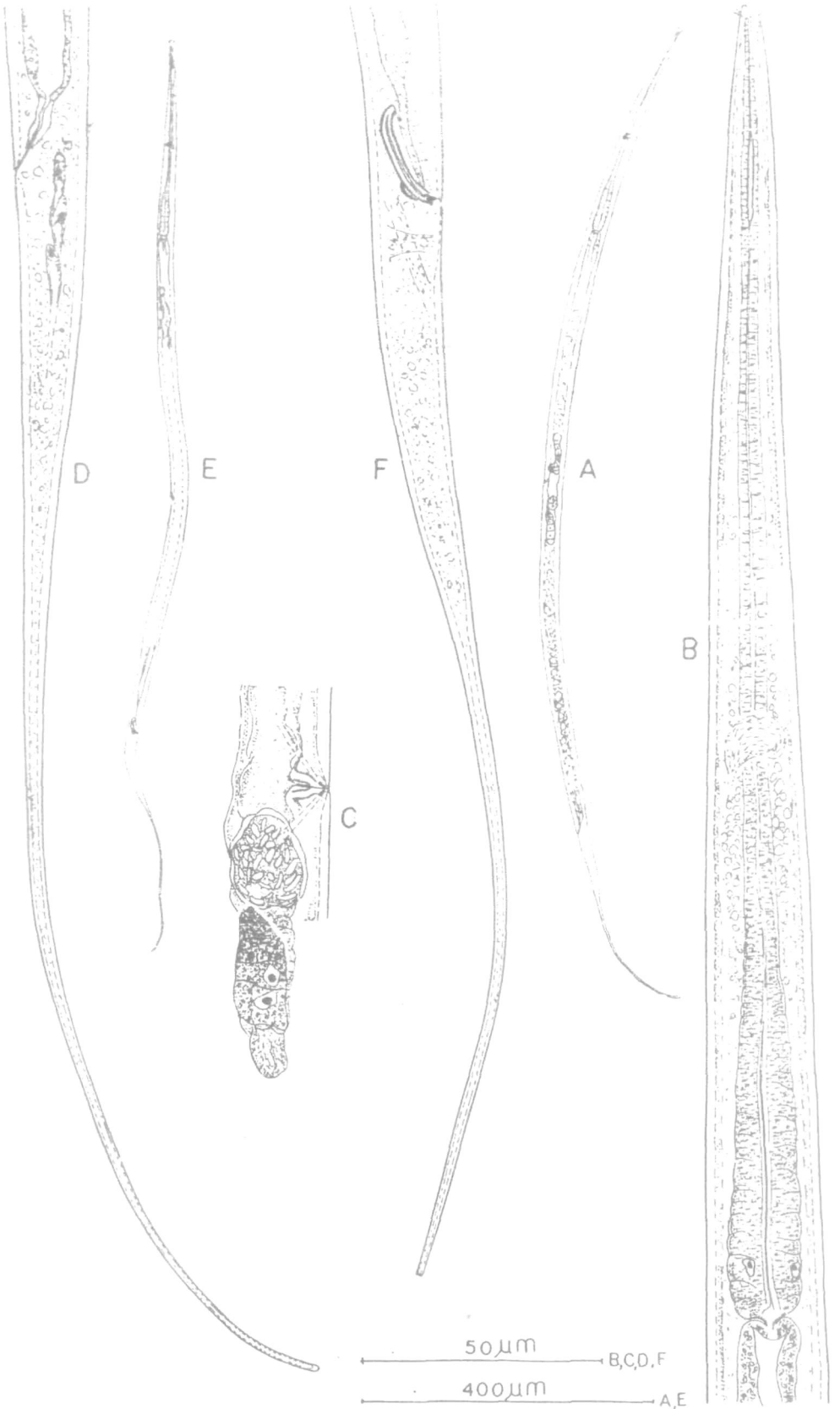
A - Entire female
B - Anterior end
C - Female gonad showing posterior uterine branch
D - Female tail
E - Entire male
F - Male tail.

TABLE - 1

Characters	Paratype (1) ♀	Paratype (2) ♀	Paratype (3) ♀	Paratype (4) ♂
Body length L = (mm)	1.2	1.3	1.4	1.2
Maximm body width (µm)	24	26	28	21
a	51	51	50	60
Neck length (µm)	287	289	306	275
b	4.3	4.6	4.5	4.6
Tail length (µm)	275	270	274	280
c	4.4	4.9	5	4.4
Anal body width (µm)	14.5	16	16	18
c' (Tail length/anal body width)	18	17	17	15.5
V	46.5	45	45.5	-
Anterior gonad(µm)	90	94	86	-
Posterior gonad(µm)	115	113	106	-
Body width at cephalic setae(µm)	4	4	4	3.5
Anterior end to cephalic setae(µm)	3.5	3.5	3.5	3
Anterior end to fovea(µm)	24	23	23	22
Amphidial fovea(µm)	21	21	22	21
Nerve ring(µm)	155	155	160	155
Vagina(µm)	9	9	9	-
Rectum(µm)	26	28	26	26
Cuticle(µm)	2	2	2.5	2

Table - 1 ..... contd. ....

Characters	Paratype (1) ♀ ♦	Paratype (2) ♀ ♦	Paratype (3) ♀ ♦	Paratype (4) ♂
Oeso. dia.(µm)	13.5	15.	15	11
Distance unto vulva(µm)	572	598	640	-
Length of testis(µm)	-	-	-	695
O_1	7.3	7	6	-
O_2	9.4	8.9	7.8	-
Lateral guiding pieces(µm)	-	-	-	10
Gubernaculum (µm)	-	-	-	10
spicules (µm)	-	-	-	28


D
E
F
A
B
C
50µm
B,C,D,F
400µm
A,E

NEMATODES FROM WEST BENGAL (INDIA)
XVIII. STUDIES ON THE SPECIES OF THE SUBFAMILY TYLENCHORHYNCHINAE (TYLENCHORHYNCHIDAE : TYLENCHIDA)

BY

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ABSTRACT

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959 is being recorded from several localities of Burdwan, Birbhum, Murshidabad and West Dinajpur districts of West Bengal. *Tylenchorhynchus goldeni* Rashid & Singh, 1982 is being considered a synonym of *T. mashhoodi*. The study of the type specimens of *Tylenchorhynchus swaruni* Singh & Khera, 1978 reveals that it is a synonym of *T. goffarti* Sturhan, 1966. The paper also reports the morphometric variations in *T. goffarti*. *Quinisulcius capitatus* (Allen, 1955) Siddiqi, 1971 and *Merlinius affinis* (Allen, 1955) Siddiqi, 1970 are being reported for the first time from West Bengal.

INTRODUCTION

Singh & Khera (1978) and Chaturvedi & Khera (1979) have reported *T. mashhoodi* Siddiqi & Basir, 1959 from the rhizosphere of different hosts at Howrah, 24-Parganas, Hooghly, Nadia, Burdwan, Bankura and Murshidabad districts of West Bengal. Singh & Khera (1978) have also described a new species *Tylenchorhynchus swaruni* (= now *T. goffarti* Sturhan, 1966) from 24-Parganas and Hooghly districts. *Tylenchorhynchus nudus* Allen, 1955 has been reported by Baqri & Ahmad (1981) from district Jalpaiguri (West Bengal). Baqri & Ahmad (l.c.) have also studied the morphometric variations in *T. nudus*.

The recent extensive and intensive surveys of plant and soil nematodes conducted by the authors in several districts of West Bengal have revealed that Tylenchorhynchus mashhoodi is a widely distributed species.

The present study mainly deals with the morphometric variations in T. zefferti and concludes that T. swarupi Singh & Khera, 1978 is a synonym of the former. Our observations are based on the study of the type specimens of T. swaruni, available in the National Collection of Zoological Survey of India.

MATERIAL

All the specimens have been mounted in anhydrous glycerin, registered and deposited in the National Collection of Zoological Survey of India. The type specimens (n = 24 ♀♀ & 12 ♂♂) of Tylenchorhynchus swaruni Singh & Khera, 1978, available in the National Collection of Zoological Survey of India, have also been included in the present study.

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959
(Fig. 1, A - C)

Syn. 1959. Tylenchorhynchus mashhoodi Siddiqi & Basir
Proc. 46th Indian Sci. Congr. Part IV (Abs.), 36.
1961. Tylenchorhynchus mashhoodi Siddiqi,
Z. Parasitenkunde, 21 : 56-58.

1970. Tylenchorhynchus mashhoodi Baqri & Jairajpuri, Rev. Brasil. Biol., 30 : 61-64.

1978. Tylenchorhynchus mashhoodi Singh & Khera, Bull. Zool. Surv. India, 1 : 27-28.

1979. Tylenchorhynchus mashhoodi Chaturvedi & Khera, Zool. Surv. India. Tech. Monogr. No. 2 : 8-9 pp.

1982. Tylenchorhynchus maldeni Rashid & Singh, Indian J. Nematol., 12 : 193-195, new synonymy.

Dimensions:

Females (10): L (mm) = 0.53-0.64 (0.60); SD = 0.04; a = 25-29 (28); SD = 1.20; b = 4.8-5.5 (5.1) SD = 0.37; c = 12-18(15) SD = 1.89; c' = 2.5-3.5 (3.2) SD = 1.96; V = 52-57 (55.7) SD = 1.83; G_1 = 20-29 (23) SD = 2.94; G_2 = 19-26 (21.6) SD = 1.90; Stylet (µm) = 15-19 (15.9) SD = 1.20; Metenchium (µm) = 8-10 (8.5) SD = 0.66; a = 50-56 (53.5) SD = 1.20.

Males (10): L (mm) = 0.49-0.60 (0.55) SD = 0.04; a = 27-31 (28) SD = 1.85; b = 4.6-5.1 (4.9) SD = 0.15; c = 14-16 (14.8) SD = 0.92; c' = 2.5-3.0 (2.7) SD = 0.23; T = 39-52 (45.8) SD = 4.36; Stylet (µm) = 15-17 (15.8) SD = 0.92; Metenchium (µm) = 8-9 (8.3) SD = 0.42; m = 50-53 (52) SD = 1.41; Spicules (µm) = 19-22 (19.4) SD = 3.40; Gubernaculum (µm) = 10-12 (10.5) SD = 0.67.

Habitat and locality: Soil around roots of paddy (Oryza sativa L.) at Saldar, District Burdwan.

Other localities: Several localities in the Districts of Burdwan, Birbhum, Murshidabad and West Dinajpur.

Discussion: Rashid & Singh (1982) described a new species Tylenchorhynchus goldeni from soil around roots of sugar cane hybrid, at Lucknow (U.P.) and differentiated it from T.annulatus (Cassidy, 1930) Golden, 1971 and T. mashhoodi. From T.mashhoodi they have differentiated T. goldeni in having a longer body, longer stylet, lower value of b and larger number of tail annules. While comparing with the dimensions and description provided by Allen (1955) and Baqri & Jairajpuri (1970) of T. mashhoodi, it is hereby noted that differential characters used by Rashid & Singh (1982) are either overlapping or insignificant. These are as follows: L = 0.57-0.82 mm against L = 0.54-0.76 mm in T. mashhoodi; stylet = 16-19 µm against 16-19 µm in T. mashhoodi; tail annules = 19-36 against 14-29 in T. mashhoodi.

This comparison reveals that the only character in which the description of T. goldeni differs from T. mashhoodi is the higher number of tail annules. Moreover, we feel that 19-36 tail annules against 14-29 should not be treated as diagnostic character because this has been found highly variable character in Tylenchorhynchus species (Baqri & Ahmad, 1981 in T. nudus; and the present study in T. goffarti). It is, therefore, proposed that T. goldeni is a synonym of T. mashhoodi.

Tylenchorhynchus zeffarti Sturhan, 1966

(Fig. 1, D - F)

Syn. 1970. Tylenchorhynchus zeffarti Baqri & Jairajpuri, Rev. Brasil. Biol., 30 : 64-65.

1978. Tylenchorhynchus swarupi Singh & Khera, Bull. zool. Surv. India, 1: 25-28, new synonymy.

Dimensions:

Narendrapur population: Table I

Birbhum population:

Females (9): L (mm) = 0.57-0.63 (0.61) SD = 0.03; a = 31-34 (32.5) SD = 1.01; b = 4.8-5.3 (5.1) SD = 0.17; c = 14-15 (14.2) SD = 0.44; c' = 3.0-3.6 (3.4) SD = 0.18; V = 54-60 (52) SD = 1.83; G_1 = 23-28 (25) SD = 1.67; G_2 = 20-22 (23) SD = 2.65; Stylet (µm) = 16-17 (16.4) SD = 0.53; Metenchium (µm) = 8-9 (8.6) SD = 0.49; m = 50-56 (52) SD = 2.50.

Male: L (mm) = 0.62; a = 31; b = 5.1; c = 15; c' = 3.0; T = 41; stylet (µm) = 16.0; Metenchium (µm) = 8.0; m = 53.

Description : Female : Cuticle transversely striated 1-2 um apart. Longitudinal striations absent. Lateral fields marked by 4 incisures, 1/5th - 1/4th the body-width near middle. Lip region set off from the body, bearing 5-6 indistinct striae, 6-8 µm wide and 3-4 µm high. Head framework slightly sclerotized. Stylet 1.6-2.3 head-width long, its anterior part (metenchium) 50-57% of stylet length. Stylet knobs sloping downward, 3-4 µm wide. Orifice of dorsal oesophageal gland about 2 µm from base

base of stylet. Median oesophageal bulb ovate, 46-54% of oesophageal length. Hemizonid prominent, 2-3 annules long, situated 0-5 annules from excretory pore. Vulva a transverse slit. Vagina about 1/2 the corresponding body-width. Genads typical to the genus. Spermatheca functional, ovate or spherical in shape. Tail with a smooth rounded terminus, marked with 32-43 annules ventrally. Post intestinal sac about 1.1-1.3 anal body-width long. Phasmids in the anterior half, 36-40% of tail from anus.

Male: Male resembles females in general morphology. Spicules 18-24 (21.3) µm long medially. Gubernaculum trough shaped, 7-10 (8.8) µm long. Tail elongate conoid with acute terminus, 2.6-3.2 times the anal body diameter long. Phasmids in the anterior half, 33-40% of the tail.

Morphometric and Allometric variations: The various morphometric and allometric characters analysed statistically for their variability in adults (Narendrapur population) are presented in Table I. This has been noted that the position of median oesophageal bulb, excretory pore and vulva are significantly correlated with body length. The coefficient of correlations are respectively R = 0.707, 0.728 and 0.929. The length of tylet (R = 0.432), oesophagus (R = 0.659), gonads (R = 0.802) and tail (R = 0.234 in females and 0.460 in males) are not significantly correlated with the body length.

Among the various morphometric and allometric characters evaluated for their variability, the length of stylet and value of V have been found least variable, their C.V. being 2.9-3.0% and 3.1% respectively. The highly variable characters (C.V.> 10%) are length of genital branches (C.V. = 11-14%), vagina (C.V. = 14%), value of c (C.V.= 13%), and tail length (C.V. = 11% in males only), length of gubernaculum (C.V. = 12%), and tail annules (C.V. = 24%). Remaining characters have been found either moderately variable (C.V. = 4-6%) or markedly variable (C.V. = 7-10%).

Remarks: The present description, based on 42 paratypes of T. swarupi, agrees with the description provided by Singh & Khera (1978) except the differences noted by us in the tail terminus and the fusion of the inner two incisures in tail region. Surprisingly they (l.c.) have reported and illustrated striated tail terminus whereas our study confirms that the tail terminus is smooth (Fig. 1, H). This is further being confirmed that inner two incisures fuse well below the phasmids in the tail region (after Singh & Khera), the inner two incisures fuse at the phasmids.

Singh & Khera (1978) described T. swarupi from Narendrapur district 24-Parganas (West Bengal) and separated it from T. [illegible] Upadhyay et al 1974, T. brevilineatus Williams, 1960 and T. brassicae Siddiqi, 1966. The present study reveals that

their observations on tail terminus as striated instead of smooth, has led the misidentification of I. soffarti as a new species. In fact, the specimens belong to T. soffarti. Hence, T. swaruni is hereby proposed a synonym of T. soffarti. Singh & Khera (1978) were having 42 paratypes of T. swaruni but they measured only 10 females and 10 males.

Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971
(Fig. 1, G-J)

1961. Tylenchorhynchus capitatus Siddiqi, Z. parasitenkunde 21 : 62-63.

1975. Quinisulcius capitatus Coomans & Saltakoglu, Meled. Fac. Landbwal. Gent. 40 : 497-500.

Dimensions:

Female (7): L (mm) = 0.67-0.76 (0.72) SD = 0.04; a = 30-33 (30.6) SD = 1.72; b= 4.9-5.5 (5.2) SD = 0.21; c = 14-16 (15) SD = 0.90; c' = 2.6-2.9 (2.7) SD = 0.10; V = 52-59 (55) SD = 2.30; G_1 = 25-29 (27) SD = 1.27; G_2 = 22-25 (24) SD = 0.89; stylet (µm) = 17-18 (17.2) SD = 0.39; metenchium (µm) = 8.5-9.1 (9.0) SD = 0.19; m = 50-53 (52) SD = 1.46.

Description:

Female: Cuticle transversely striated, 1-2 µm apart. Longitudinal lines absent. Lateral fields marked by five incisures 1/5th - 1/4th of the body-width near middle. Lip region set off from the body, bearing 5-6 annules, 4-5 µm high and about 8 µm

wide. Head framework slightly sclerotized. Stylet 2.1-2.3 times the head-width, its anterior part (metenchium) 50-53% of the stylet length. Stylet knobs indented anteriorly, about 4.0-4.5 µm wide. Hemizonid about 2 annules long, situated at 1.5 annules above the excretory pore. Tail cylindrical, ending in an acute smooth terminus, marked with 37-44 annules ventrally. Phasmids in the anterior half (23-37%) of the tail.

Male: Not found.

Habitat and locality: From soil around roots of Citrus sp. at Dalapehand basti, Kalimpond, Darjeeling, West Bengal.

Merlinius affinis (Allen, 1955) Siddiqi, 1970
(Fig. 1, K - N)

Dimensions:

Female (4): L (mm) = 0.78-0.91 (0.84) SD = 0.06; a = 20-21 (20.9) SD = 0.82; b = 5.2-6.0 (5.5) SD = 0.36; c = 13-16 (15) SD = 1.41; c' = 1.41-2.41 (1.87) SD = 0.42; V = 53.56 (54) SD = 1.50; G_1 = 20-21 (20.5) SD = 0.58; G_2 = 14-20 (18.0) SD = 2.83; Stylet (µm) = 26-28 (27.1) SD = 0.85; metenchium (µm) = 14-14.5 (14.4) SD = 0.25; m = 52-54 (53) SD = 0.96.

Male (2) : L (mm) = 0.78-0.87 (0.82) SD = 0.07; a = 22-24 (23) SD = 1.41; b = 5.4-5.6 (5.5) SD = 0.14; c = 12-17 (14.5) SD = 3.54; c' = 1.93-2.5 (2.3) SD = 0.43; T = 29-40(35.4)

SD = 7.78; stylet (µm) = 26-28 (27.0) SD = 1.42; metenchium (µm) = 13-15 (14) SD = 1.41.

Description:

Female: Cuticle transversely striated, 2 µm apart. Longitudinal lines absent, lateral fields 1/5th - 1/4th of the body near the middle. Lip region slightly set off from the body, flat at apex, bearing 6 annules, 3-4 µm high and 6.5 to 8.0 µm wide. Head framework heavily sclerotized. Stylet 2.6-2.8 times the head width, its anterior part (metenchium) about 50-54% of stylet length. Stylet knobs slightly indented anteriorly, 5.5-6.5 µm wide. Hemizonid 1-2 annules long, situated 0-1 annule above the excretory pore. Gonads typical to genus. Tail broadly rounded, marked with 28-34 annules, ventrally. Phasmids in the anterior half (30-35%) of the tail.

Male: Similar to females in general morphology except the male genital system and tail shape. Spicules 24 µm medially. Gubernaculum stout, 6 µm long. Tail elongate conoid with acute terminus, 1.9-2.5 times the anal body diameter. Phasmids in the anterior half (37-45%) of the tail.

Habitat and locality: From soil around roots of Tea (Thea sinensis L.) at Lebong, Darjeeling, West Bengal.

ACKNOWLEDGEMENT

The authors are grateful to the Director, Zoological Survey of India for providing research facilities. The financial assistance from I.C.A.R., New Delhi to conduct the surveys under All India Coordinated Research Project on Nematode Pests of Crops and Their Control is also acknowledged.

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TABLE - I

Morphometric and Allometric Variations in Adults of Tylenchorhynchus offarti

Character	Female (n= 24, paratypes of T. swarupi) Range	Mean ± S.D.	C.V. (%)	Male (n= 18, paratypes of T. swarupi) Range	Mean ± S.D.	C.V.(%)
Length (µm)	478–637	558 ± 36.27	6.5	458–637	534 ± 44.00	8.5
a	26–33	30 ± 1.84	6.1	28–35	33 ± 2.68	8.1
b	4.7–5.7	5.1±0.28	5.5	4.5–5.8	5.0 ± 0.36	7.2
c	13–17	15 ± 1.28	8.5	13–22	16.5 ± 2.09	13.0
c'	2.6–3.2	2.9 ± 0.16	5.5	2.3–3.0	2.7 ± 0.24	8.9
V/T	52–58	53 ± 1.64	3.1	55–66	61 ± 3.56	5.8
G_1	24–30	27 ± 2.37	8.8	–	– –	–
G_2	20–30	25 ± 2.51	10.0	–	– –	–
m	50–57	53 ± 2.11	4.0	49–54	53 ± 2.53	4.8
Head height (µm)	3–4	3.3 ± 0.20	6.1	3–4	3.2 ± 0.20	6.4
Head width (µm)	6–8	6.8 ± 0.46	6.8	6–8	6.4 ± 0.62	9.7
Stylet (µm)	13–14	13.4 ± 0.39	2.9	13–14	13.2 ± 0.55	3.0
Stylet knobs (µm)	3–3.5	3.04± 0.14	4.6	3–3.5	3.03± 0.14	4.6
Metanchium (µm)	7–8	7.1 ± 0.42	5.9	7–8	7.2 ± 0.38	5.3
Oesophagus* (µm)	100–121	109 ± 5.27	4.8	100–115	107 ± 4.12	3.9
Median bulb* (µm)	49–58	54 ± 2.80	5.2	49–54	53 ± 2.53	4.8
Median oesophageal bulb length (µm)	10–13	12.4± 0.49	4.0	10–13	11.8± 0.81	6.9
Median oesophageal bulb width (µm)	8–10	9.4± 0.65	6.9	7–10	8.6± 0.78	9.1
Nerve ring* (µm)	66–76	71 ± 3.13	4.4	66–74	69 ± 2.52	3.7
Excretory pore (µm)	80–95	88 ± 3.94	4.5	79–94	87 ± 3.24	3.7
Vulva* (µm)	264–343	304 ± 18.50	6.1	–	– –	–
Anterior gonad (µm)	126–195	154 ± 17.50	11.0	–	– –	–
Posterior gonad (µm)	108–182	141 ± 19.56	14.0	–	– –	–
Vagina (µm)	9–13	10.3± 1.17	14.0	–	– –	–
Vulva body width (µm)	16–22	19 ± 1.72	9.1	14–19	17 ± 1.70	10.0
Anal body diameter(µm)	12–15	12.6± 1.01	8.0	11–13	11.9± 0.73	6.1
Rectum (µm)	9–11	9.8± 0.64	6.5	–	– –	–
Tail (µm)	35–44	38 ± 3.16	8.3	25–39	32 ± 3.38	11.0
Tail annules	24–45	35 ± 8.50	24.0	–	– –	–
Spicules (µm)	–	– –	–	18–24	21.3± 1.28	6.0
Gubernaculum (µm)	–	– –	–	7–10	8.8± 1.06	12.0

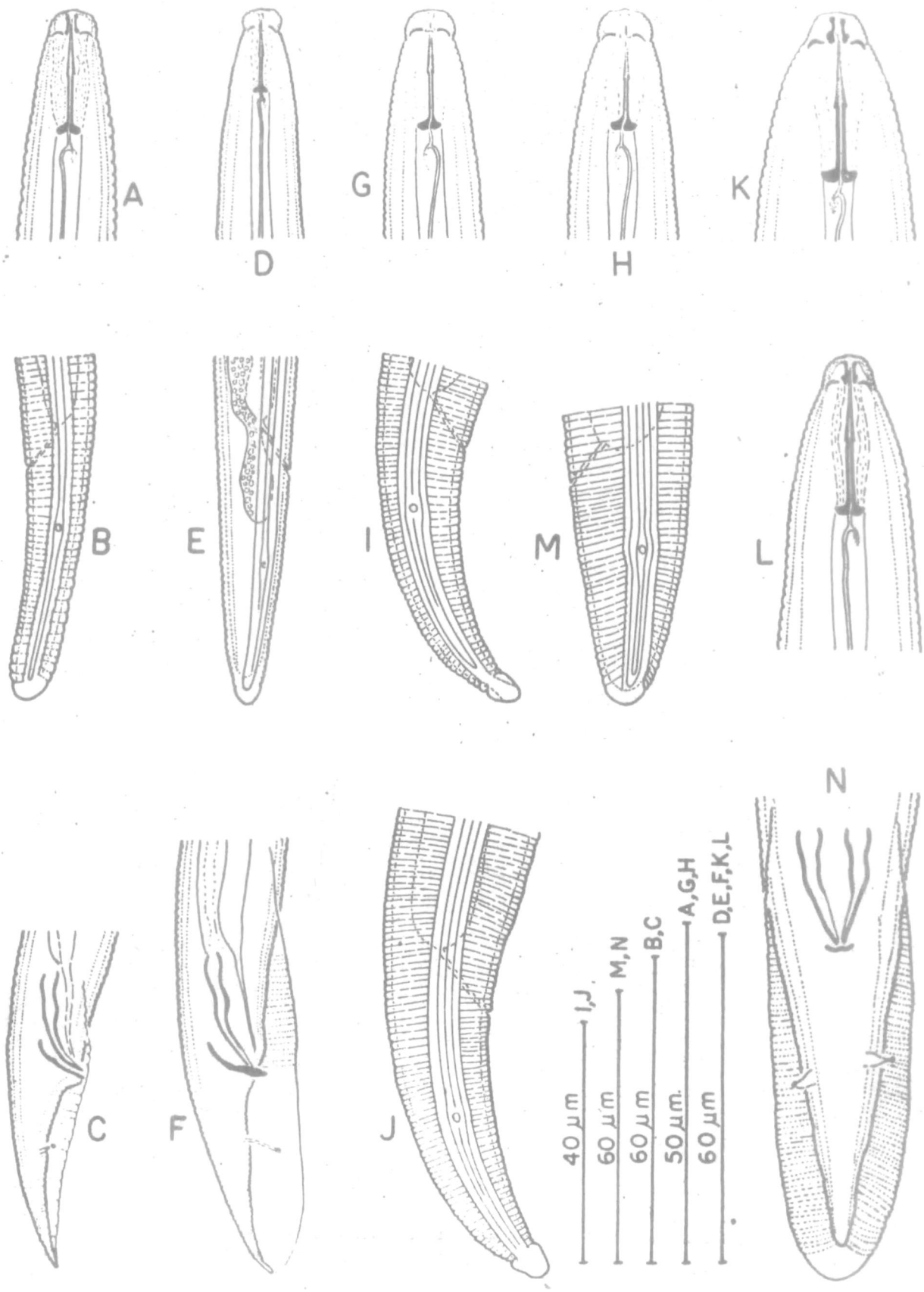
* Distances from anterior end

S.D. = Standard deviation

C.V. = Coefficient of variability

LEGENDS

Fig. 1. *Tylenchorhynchus nashhoodi* (A-C): A: Anterior end; B: Female tail; C: Male tail. *T. zeffarti* (D-F): D: Anterior end; E: Female tail; F: Male tail. *Quinisulcius capitatus* (G-J): G & H: Anterior end; I & J: Female tails. *Merlinius affinis* (K-N): K & L: Anterior end; M: Female tail; N: Male tail.


A
D
G
H
K
B
E
I
M
L
C
F
J
N
40 µm
I,J
60 µm
M,N
60 µm
B,C
50 µm
A,G,H
60 µm
D,E,F,K,L

NEMATODES FROM WEST BENGAL (INDIA). XIX. QUALITATIVE AND QUANTITATIVE STUDIES OF PLANT AND SOIL INHABITING NEMATODES ASSOCIATED WITH PADDY CROP IN WEST DINAJPUR DISTRICT

BY

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ABSTRACT

During May 1982, a random survey was conducted at 14 villages under four developmental blocks (Balurghat, Hilli, Islampur and Kumarganj) of West Dinajpur district (W. Bengal) to make the qualitative and quantitative studies of plant and soil inhabiting nematodes associated with paddy crop. Sixtyfive soil samples were collected. In all 35 species belonging to the orders Tylenchida, Dorylaimida and Mononchida have been identified, of which 16 belong to the parasitic group of the order Tylenchida. The quantitative study reveals that Hirschmanniella gracilis, Tylenchorhynchus mashhoodi and Helicotylenchus spp. are most abundant in the area surveyed. The other important parasitic nematodes are Meloidogyne graminicola and Ditylenchus spp. Hirschmanniella gracilis was found a key nematode pest of paddy in West Dinajpur district of West Bengal.

INTRODUCTION

During May 1982, a random survey was conducted to make the qualitative and quantitative studies of parasitic nematodes associated with paddy crop in West Dinajpur district of West Bengal. Sixtyfive soil samples were collected from the following developmental blocks of West Dinajpur : Balurghat, Islampur, Hilli and Kumarganj.

MATERIAL AND METHODS

The sampling was made at random. For the quantitative study, the samples were processed and the nematode populations were estimated as described by Baqri *et al.* (1983).

RESULTS

A. QUALITATIVE STUDY:

Upon analysis, the samples yielded 16 stylet bearing nematode species belonging to 12 genera of the order Tylenchida. In addition to this, 19 soil inhabiting or predacious species of the orders Dorylaimida and Mononchida have also been identified. The identified species are listed below:

Order TYLENCHIDA Thorne, 1949

1. *Tylenchus goodeyi* Das, 1960
2. *Ditylenchus* spp.
3. *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959
4. *Hoplolaimus indicus* Sher, 1963
5. *Helicotylenchus indicus* Siddiqi, 1963
6. *H. egyptiensis* Tarjan, 1964
7. *H. retusus* Siddiqi & Brown, 1964
8. *H. microcephalus* Sher, 1966
9. *Pratylenchus scribneri* Steiner, 1943
10. *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963
11. *Rotylenchulus reniformis* Lindford & Oliveira, 1940

12. Hoplotylenchus acutus Husain & Khan, 1968
13. Meloidogyne graminicola Golden & Birschfield, 1966
14. Macronosthonia ornata (Raski, 1958) De Grisse & Loof, 1965
15. M. arenata (Loof, 1964) De Grisse & Loof, 1965
16. Anhelenchoides subtenuis (Cobb, 1926) Steiner & Buhrer, 1932

Order DORYLAIMIDA (de Man, 1876) Pearse, 1942

17. Dorylaimus thornei Andrassy, 1969
18. Laimydorus baldus Baqri & Jana, 1982
19. Discolaimium andrassyi Baqri & Khera, 1976
20. Discolaimoides bulbiferous (Cobb, 1906) Heyns, 1963
21. Lenonchium oryzae Siddiqi, 1965
22. Jairajpuria shamimi Baqri & Jana, 1980
23. Anoreolaimellus heynsi Baqri & Jairajpuri, 1968
24. A. chauhani Baqri & Khera, 1975
25. Dorylaimellus indicus Siddiqi, 1964
26. Paraoxydirus gigas (Jairajpuri, 1964) Jairajpuri & Ahmad, 1979
27. Discomycetus elongatus Dhanachand & Jairajpuri, 1980
28. Tylencholaimus pakistanensis Timm, 1964
29. Prolentonchus indicus Siddiqi & Khan, 1964
30. Tylaptus variablis Jairajpuri & Loof, 1964
31. Dorylaimoides teres Thorne & Swanger, 1936
32. D. armatus Siddiqi, 1964
33. D. leptura Siddiqi, 1965
34. Laevides imphalus Ahmad & Jairajpuri, 1980

Order MONONCHIDA Jairajpuri, 1969

35. Mononchus aquaticus Coetzee, 1968

B. QUANTITATIVE STUDY:

The results of the quantitative estimation of different parasitic nematode genera and other nematodes (dorylaims, rchabditids and mononchs) have been analysed in TABLE I. The details of the sampling and localities have also been given in the same table. Sixtyfive samples were collected from 14 village centres and their surroundings in four developmental blocks of West Dinajpur district.

The quantitative study reveals that among the plant parasitic nematodes in West Dinajpur district, the species of the following four genera are most abundant: Hirschmanniella Luc & Goodey, 1963; Tylenchorhynchus Cobb, 1913; Helicotylenchus Steiner, 1945; and Meloidogyne Goeldi, 1887. Upon analysis, the frequency of occurrence of Hirschmanniella gracilis has been noted in 83% and was found dominating over other plant parasitic nematodes in 48% samples. The occurrence of Tylenchorhynchus mashhoodi and Helicotylenchus spp. has been noted in 85% and 82% samples but dominated only in 14% and 20% soil samples respectively. Meloidogyne graminicola has been recorded from 45% samples but the dominance was noticed only in 12% samples. The other potential nematode pests in the area are Ditylenchus spp. Though the frequency of their occurrence was noted in 58% soil samples but were found

dominating only in 5% samples. Monolaimus indicus and Macroposthonia ornata were also encountered but in small numbers.

The present study concludes that Hirschmanniella gracilis is the key nematode pest in the area surveyed. The other important nematode pests of paddy in West Dinajpur district are Meloidogyne graminicola, Tylenchorhynchus mashhoodi and Helicotylenchus spp.

TABLE - I

Results of the survey of Paddy crop in West Dinajpur district of West Bengal State.

Range of Nematode number with its average per 200 of soil.

Figures as parenthesis indicate percent frequency of occurrence.

	V I L L A G E S				
	Dolla	Tikaderpara	Mamma	Chakkhasi	Mahadevpur
No. of samples collected	4	4	3	7	6
Nematode associated.					
1. Ditylenchus	30-60:50 (75)	20-20:20 (50)	10-20:15 (66.67)	10-30:23 (42.86)	10-50:35 (66.67)
2. Helicotylenchus	10-160:70 (75)	20-30:25 (50)	20-80:40 (100)	10-50:37 (85.17)	20-210:68 (83.33)
3. Hirschmanniella	140-1470:668 (100)	50-710:303 (75)	10-310:160 (66.67)	130-740:434 (100)	450-1150:785 (66.67)
4. Hoplolaimus	-	-	-	-	-
5. Macronosthonia	-	-	-	-	-
6. Meloidogyne	30-2030:810 (75)	-	10-70:40 (66.67)	30-120:75 (23)	10-50:27 (50)
7. Tylenchorhynchus	30-70:48 (100)	30-500:206 (75)	20-30:27 (100)	10-30:18 (85.17)	10-130:77 (50)
8. Saprophagous	40-480:218 (100)	30-70:53 (100)	40-210:117 (100)	10-770:173 (100)	10-950:302 (100)

..... contd. .....

Table - I .... contd. .....

	VILLAGES			
	Saronbail	Uzal Moza	Barekam	Gopalganj
No. of samples collected	3	3	3	3
Nematode associated.				
1. Ditylenchus	30-30: 30 (66.67)	20-50: 35 (66.67)	10-10: 10 (66.67)	10-90: 55 (100)
2. Helicotylenchus	30-50: 50 (67)	40-110: 73 (100)	10-60: 43 (100)	210: 210 (33.33)
3. Hirschmanniella	110-360: 230 (100)	10-60: 35 (66.67)	80-260: 160 (100)	70-410: 193 (100)
4. Hoplolaimus	-	20: 20 (33.33)	-	-
5. Macroposthonia	-	20: 20 (33.33)	-	-
6. Meloidogyne	20: 20 (33.33)	110-450: 257 (100)	-	520: 520 (33.33)
7. Tylenchorhynchus	10-30: 23 (100)	20-690: 260 (100)	20-50: 33 (100)	10-100: 60 (100)
8. Saprophagous	40-200: 106 (100)	130-430: 230 (100)	50-200: 125 (66.67)	10-570: 290 (66.67)

..... contd. .....

Table I .... contd. .....

	V I L L A G E S				
	Tluabari	Phoolbari	Khokobasti	Ramgaunj	Taringibari
No. of samples collected.	6	5	6	8	4
Nematode associated					
1. Ditylenchus	10-50: 22 (83.33)	30-30: 30 (40)	10-50: 34 (83.33)	10-20: 15 (50)	10-20: 15 (50)
2. Helicotylenchus	30-350: 132 (83.33)	30-190: 98 (100)	40-450: 185 (66.67)	10-50: 34 (100)	20-270: 90 (100)
3. Hirschmanniella	10-110: 37 (100)	10-130: 66 (100)	20-20: 20 (33.33)	10-130: 60 (75)	10-70: 43 (100)
4. Hoplolaimus	-	-	-	-	170: 170 (25)
5. Macronesthonia	10-90: 23 (100)	10-170: 70 (60)	30-180: 85 (66.67)	10-50: 25 (50)	10-50: 27 (75)
6. Meloidogyne	40-270: 205 (33.33)	30-660: 257 (60)	10-30: 20 (83.33)	10-20: 13 (37.5)	10-150: 60 (100)
7. Tylenchorhynchus	10-110: 48 (100)	10-190: 70 (100)	30-150: 77 (50)	10-40: 26 (62.5)	10-440: 130 (100)
8. Saprophagous	70-750: 366 (100)	150-240: 190 (100)	30-1090: 320 (100)	50-210: 114 (87.5)	60-1200: 445 (100)

ACKNOWLEDGEMENT

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SPECIES OF THE GENUS XIPHINEMA COBB, 1913 (XIPHINEMATIDAE : DORYLAIMIDA) FROM MALAYSIA

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ABSTRACT

The soil samples collected from Malaysia yielded the following four known species of Xiphinema: X. insigne Loos,1949; X. brevicolle Lordello & Da Costa, 1961; X. basilmoodavi Coomans, 1965; X. monohysterum Brown, 1968. Besides, a new species Xiphinema ilyasi is being described which is characterized by L = 2.03 - 2.13 mm, odontostyle = 109 - 110 µm, odontophore = 59 - 62 µm, guiding ring = 90 - 92 um and tail = 23 - 26 µm.

INTRODUCTION

Dr. M. Ilyas, Lecturer, School of Physics, University of Science of Malaysia, Penang, collected and brought 10 soil samples from five different localities in Malaysia. These samples yielded five different species of Xiphinema Cobb, 1913 which are reported hereunder. One of these species is new and has been named after the collector.

MATERIAL

All the specimens are registered and deposited in the National Zoological Collection, Zoological Survey of India, Calcutta. Holotype and paratype females of X. ilyasi n. sp. are mounted on slide W.N. 492.

XIPHINEMA INSIGNE LOOS, 1949

(Fig. 1, A - C)

1949. Xiphinema insigne: Loos, J. Zool. Soc. India, 1 : 25

Measurements :

Female (1) : L = 2.29 mm; a = 52; b = 5.9; c = 26; c' = 3.8; V = $^{8}31^{8}$; odontostyle = 108 µm; odontophore = 61 µm; guiding ring = 96 µm.

Description : Female : Body upon fixation ventrally curved in posterior half of its length. Lip region slightly marked off from body. Amphids 5 µm from anterior extremity. Odontostyle about 1½ lip region-widths long. Odontophore 56% of odontostyle length. Basal expanded part of oesophagus occupying 23% of oesophageal length or 2.5 times the corresponding body-width. Female reproductive system amphidelphic. Vagina 19 µm long or slightly less than half the corresponding body-width. Tail 88 um long, elongate-conoid, with three caudal pores on each side.

Habitat and locality : Soil around roots of Jack tree, Artocarpus heterophyllus Lamk. from Balik Pulau Area, Penang, Malayasia.

XIPHINEMA BREVICOLLE LORDELLO & DA COSTA, 1961

(Fig. 1, D - G)

1961. Xiphinema brevicolle : Lordello & Da Costa, Rev. brasil. Biol. 21 : 363.

Measurements :

Females (4) : L = 1.60 - 1.84 mm; a = 41 - 45; b = 5.1 - 6.2; c = 79 - 111; c' = 0.8 - 0.9; V = $^{8-10}51 - 53^{8-9}$; odontostyle = 103 - 111 µm; odontophore = 52 - 59 µm; guiding ring = 76 - 78 µm.

Description : Female : Body 'C' shaped upon fixation. Lip region marked by a slight depression from body. Amphids about 5 µm from anterior extremity, stirrup-shaped; their apertures occupying about 43% of corresponding body-width. Odontostyle about 9 lip region-widths long. Odontophore 48-57% of the odontostyle length. Basal expanded part of oesophagus occupying 20 - 24% of oesophageal region or about 1.8 - 2.2 times the corresponding body-width. Female reproductive system amphidelphic. Vagina 15 - 18 µm long or less than half the corresponding body-width. Tail 15 - 23 µm long, rounded, its dorsal surface covex and ventral almost straight, with two caudal pores on each side.

Habitat and locality : Soil around roots of Durian tree Durio zibethinus Murr. from Balik Pulau Area, Penang, Malaysia.

XIPHINEMA BASILGOODEYI COOMANS, 1965

(Fig. 1, H - J)

1965. Xiphinema basilgoodeyi : Coomans, Nematologica, 10 : 582.

Measurements :

Female (1) : L = 2.05 mm; a = 56; b = 7.3; c = 63; c' = 1.3; V = $^{5.4}49^{5.8}$; odontostyle = 121 µm; odontophore = 62 µm; guiding ring = 114 µm.

Description : Female : Body upon fixation ventrally curved in posterior third of its length. Lip region continuous with body. Amphids 5.5 µm from anterior extremity. Odontostyle about 10 lip region-widths long. Odontophore 51% of odontostyle length. Basal expanded part of oesophagus 24% of oesophageal length or about two times the corresponding body-width. Female reproductive system amphidelphic. Vagina 25 µm long or about half of corresponding body-width. Tail 47 µm long, short-conoid, with a small peg-like structure and two caudal pores on each side.

Habitat and locality : Soil around roots of Mangosteen tree, Garcinia mangostana Linn. from Sungei Batu, Penang, Malaysia.

XIPHINEMA MONOHYSTERUM BROWN, 1968

(Fig. 1, K - N)

1968. Xiphinema monohysterum : Brown, Nematologica, 13 : 635.

Measurements :

Females (3) : L = 2.19-2.41 mm; a = 43-47; b = 5.6-6.5; c = 27-40; c' = 2.3-3.2; V = $^{8-9}24-27$; odontostyle = 112-113 µm; odontophore = 60-65 µm; guiding ring = 96-125 µm.

Description: Female : Body upon fixation ventrally curved in posterior half of its length. Lip region marked with a slight depression from body. Amphids 4.0-5.5 µm from anterior extremity, stirrup-shaped, apertures occupying 47-60% of corresponding body-width. Odontostyle about 10-11 lip region-widths long. Odontophore 54-55% of the odontostyle length. Basal expanded part of oesophagus occupying 22-24% of oesophageal region or about 1.8-1.9 times the corresponding body-width. Female reproductive system mono-opisthodelphic. Vagina 22-29 µm or about half of the corresponding body-width. Tail 61-82 µm long, elongate-conoid, with 2-3 caudal pores on each side. In one female the tail tip is broken and its length has been measured 33 µm (c = 66, c' 1.4).

Habitat and locality: Soil around roots of Jack tree, Artocarpus heterophyllus Lamk. from Balik Pulau Area, Penang, Malaysia.

XIPHINEMA ILYASI N. SP.

Syn. X. ensiculiferum apud Williams, 1959

(Fig. 2, A - F)

1959. Xiphinema ensiculiferum : Williams, Occ. Pap. Mauritius. 3. Sug. Ind. Res. Inst., No. 3

Measurements :

Holotype female : L = 2.03 mm; a = 41; b = 5.5; c = 88; c' = 0.8; V = 32^{12}; odontostyle = 110 µm; odontophore = 62 µm; guiding ring = 92 µm.

Paratype : 1 ♀: L = 2.13 mm; a = 43; b = 5.6; c = 82; c' = 0.9; V = 31^{10}; odontostyle = 109 µm; odontophore = 59 µm; guiding ring = 90 µm.

Description : Female : Body upon fixation ventrally curved in the posterior half of its length, tapering slightly towards both ends. Cuticle 2.5-7.0 µm (thickest on tail). Lateral chords about 1/5th of body-width near middle. Lip region rounded, almost continuous with body, its width about 1/5th of body-width at base of oesophagus. Amphids stirrup-shaped, their apertures 4.5-5.0 µm from anterior extremity and 6.0-6.5 µm wide or 52-54% of the corresponding body-width. Odontostyle about 10-11 lip region widths long. Odontophore with well developed basal knobs, 54-56% of the odontostyle length. Nerve ring 193-195 µm or 50-51% of oesophageal region from anterior extremity. Basal expanded part of oesophagus occupying 21-22% of neck length or 1.7-1.8 times the corresponding body-width. Positions of oesophageal gland nuclei and orifices as follows: DO = 80.0-80.4; DN = 81.2-81.4; DO-DN = 1.0-1.2; S_1N_1 = 88.3-88.8; S_1N_2 = 89.2-89.3; S_2O = 95.9-96.4. Cardia tongue-shaped, enveloped by intestinal tissue. Prerectum 326-421 µm or 11-14 anal body-widths long. Rectum 36-37 µm or about 1.2-1.3 anal body-width long. Vulva a transverse slit. Vagina 27-28 µm or about half of corresponding body-width long. Female reproductive system mono-opisthodelphic, anterior sexual branch absent. Posterior sexual branch consists of a reflexed ovary, distal narrow and proximal expanded part of oviduct, and a long

uterus. Tail short rounded, 23-26 µm or 0.8-0.9 anal body-width long, with two caudal pores on each side.

Male : Not found.

Type habitat and locality : Soil around roots of Jack tree, Artocarpus heterophyllus Lamk. from Balik Pulau Area, Penang, Malaysia.

Differential diagnosis : Xiphinema ilyasi n. sp. comes close to X. loosi Southey & Luc, 1973 and X. ensiculiferum (Cobb, 1893) Thorne, 1937. From the former it differs in the absence of anterior genital sac and the mammillate tail terminus or rudimentary mucro (anterior genital sac about 3/4th of vulva body-width and tail with slightly mammillate terminus or rudimentary mucro in X. loosi). From X. ensiculiferum the new species differs in having shorter odontostyle and odontophore, anteriorly situated guiding ring and longer tail (odontostyle = 149-158 µm; odontophore = 74-81 µm; guiding ring = 143 µm; and c' = 0.57-0.67 in X. ensiculiferum). It can further be differentiated from X. loosi and X. ensiculiferum in having lip region marked by a slight depression.

Discussion : Two females identified by Williams (1959) from Mauritius as X. ensiculiferum were tentatively considered by Southey & Luc (1973) as conspecific with X. loosi despite some significant differences because they were unable to study Williams' specimens. The type specimens of present new species,

X. ilyasi, fit well with the description provided by Williams (1959) in having almost continuous lip region or slightly marked by a depression, rounded tail and no anterior genital sac. The type specimen of X. ilyasi and Williams' specimens jointly differ from X. loosi in the following characters : Lip region continuous from body or slightly marked by a depression against offset by a slight constriction, anterior genital sac absent whereas it is about one vulva bodywidth in X. loosi, and rounded tail against mammilate tail or with a vestigial mucro associated with a terminal canal. On the basis of these differences, we feel justified to propose a new name, X. ilyasi for the specimens from Malaysia and Mauritius.

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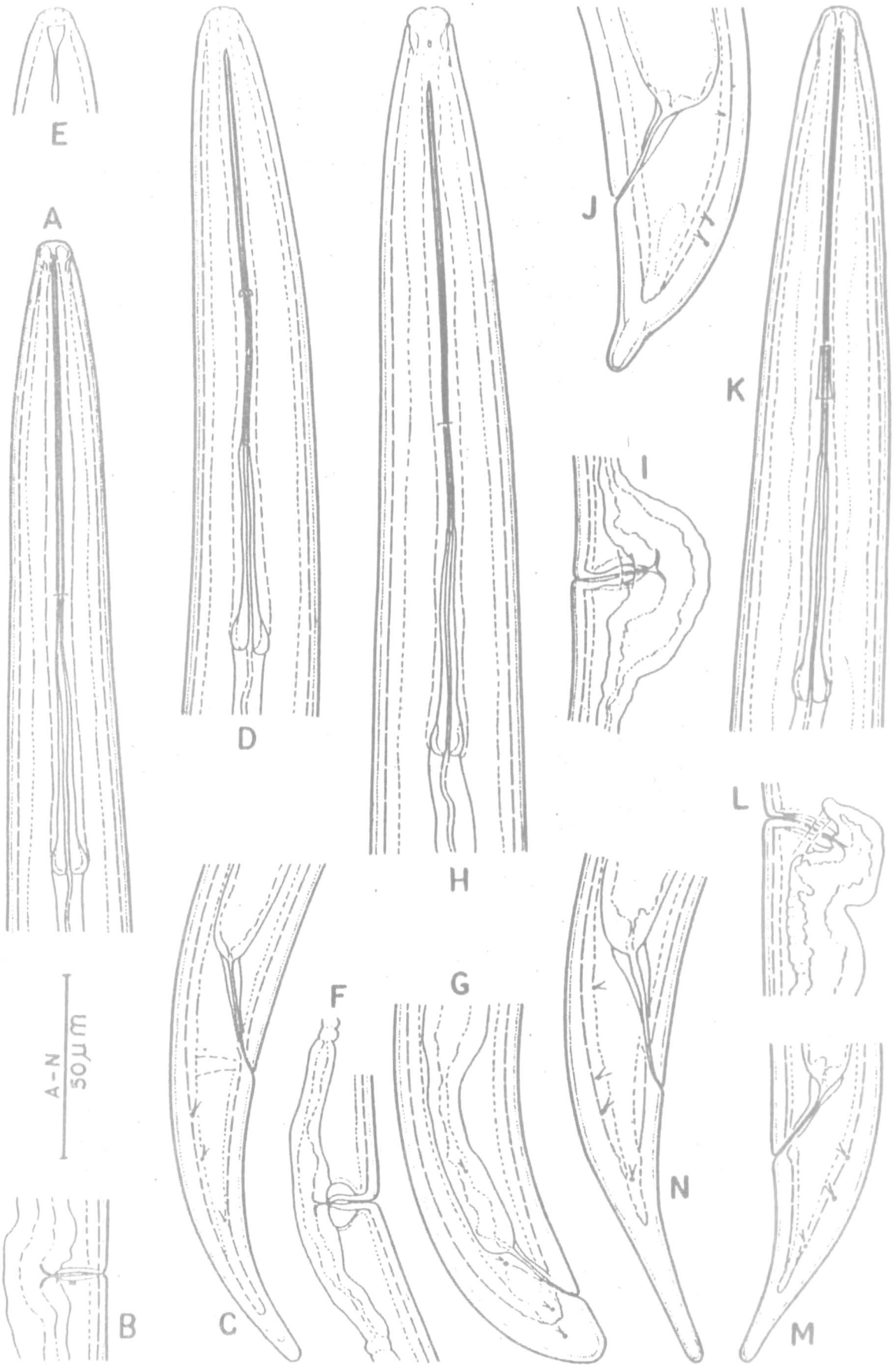
LEGENDS

Fig. 1 - A - C *Xiphinema insigne* Loos : A - Anterior end; B - Vulva region; C - Female tail; D - G *Xiphinema brevicolle* Lordello & Da Costa : D - Anterior end; E - Anterior end, superficial view; F - Vulva region; G - Female tail; H - J *Xiphinema basilgondavi* Coomans : H - Anterior end; I - Vulva region; J - Female tail; K - N *Xiphinema monohysterum* Brown : K - Anterior end; L - Vulva region; M & N - Female tail.

Fig. 2 - A - F *Xiphinema ilvasi* n. sp. : A - Entire female; B - Anterior region showing slender part of oesophagus; C - Basal expanded part of oesophagus; D - Anterior end, superficial view; E - Female reproductive system; F - Female tail.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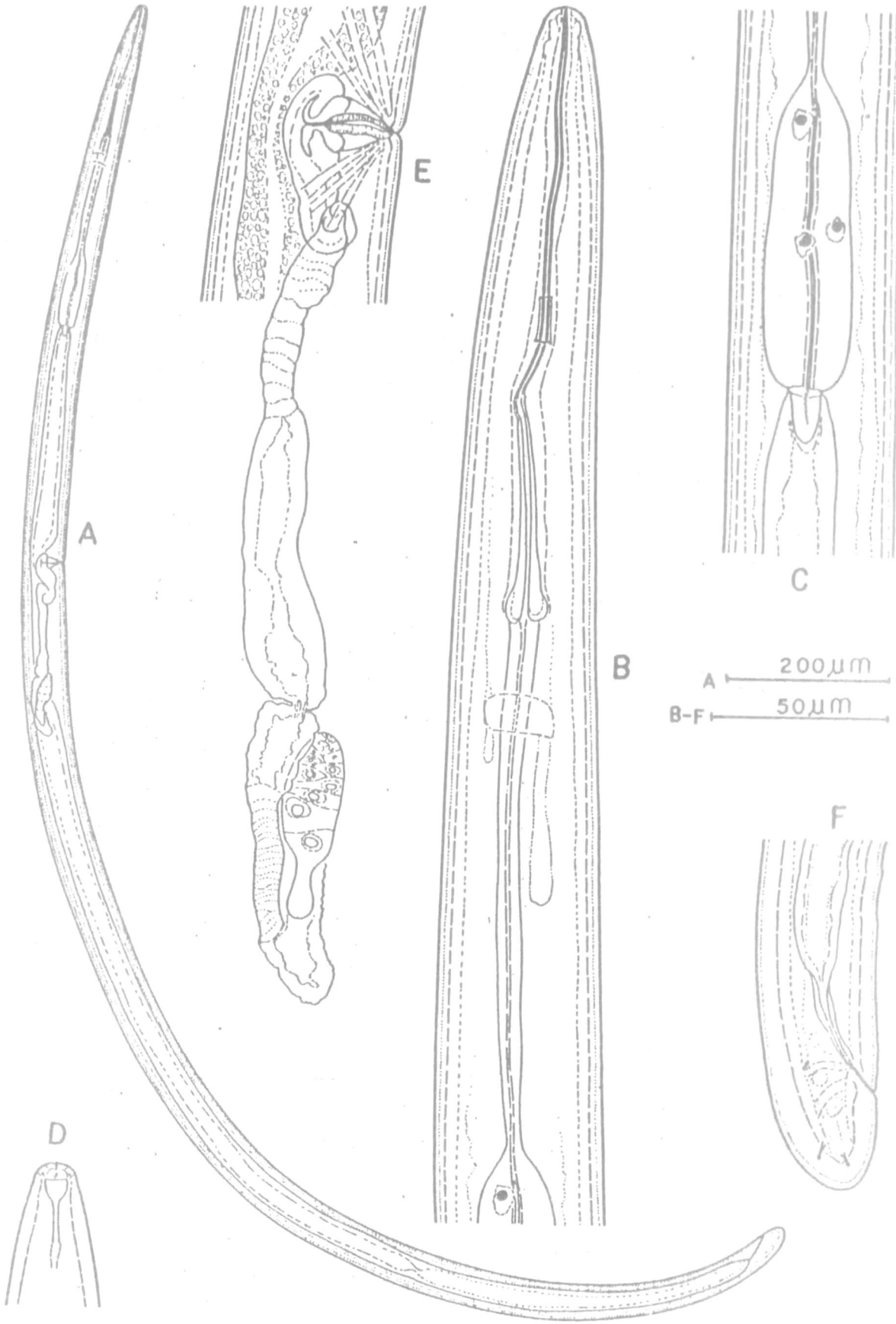
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NEMATODES FROM WEST BENGAL (INDIA). XXI.
FIVE NEW SPECIES OF DORYLAIMOIDEA (DORYLAIMIDA : NEMATODA)

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INTRODUCTION

The species of the genera Laimydorus Siddiqi, 1969 and Thornenema Andrássy, 1959 belonging to the superfamily Dorylaimoidea are widely distributed in West Bengal. This paper reports the following five new species of these two genera : Laimydorus distinctus sp. n., L. oryzae sp. n., Thornenema nodicaudatum sp. n., T. conura sp. n. and T. novum sp. n.

MATERIALS AND METHODS

The nematodes were fixed in hot 4% formalin, dehydrated in desiccator and mounted in anhydrous glycerine. The type specimens have been registered and deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

Laimydorus distinctus sp.n.
(Fig. 1)

Measurements:

Holotype female : L=6.44 mm; a= 58.5; b=6.5; c= 24.6; V= $^{8}47^{7}$

Paratype male(1): L=5.05 mm; a = 50.5; b = 5.9; c 180; T= 50

Description :

Female: Body ventrally curved upon fixation, open 'c' shaped and tapering towards both ends. Cuticle finely striated, 2-6 µm thick (thickest on tail). Lateral hypodermal chords about 1/4th of the corresponding body-widths near middle. Dorsal ventral and lateral body pores indistinct, only four dorsal pores, eight lateral pores were counted in the oesophageal region.

Lip region marked by a constriction, about 1/6th of body-width at base of oesophagus, wider than adjoining body, with distinct lips bearing the usual number of papillae. Amphids stirrup-shaped, their apertures occupying about 9 µm or 42% of the corresponding body-width and 9 µm from anterior end. Sensillar pouches 24 µm from the amphidial apertures.

Odontostyle 62 µm or 3.1 lip region-widths long; aperture occupying 14 µm or 22% of the odontostyle length. Guiding ring 45 µm or 2.2 lip region-widths from anterior end. Odontophore 66 µm or slightly longer than the odontostyle. Location of oesophageal gland nuclei and their orifices are as follows : DO = 47.22; DN = 48.43; DO-DN = 1.21; S_1N_1 = 67.6; S_1N_2 = 72.6 S_2N = 87.89; S_2O = 88.69; K = 79.1; K' = 80.1.

Nerve ring at 298 µm or 30% of the neck region from anterior end. Cardia 40 µm, tongue-shaped, surrounded by intestinal tissue. Oesophago-intestinal disc absent. Prerectum 346 µm or about 8 anal body-widths long. Rectum 52 µm or 1.2 anal body-widths long.

Vulva a longitudinal slit. Vagina 48 µm or about 39% of the corresponding body-width and surrounded by sphincter. Female reproductive system amphidelphic. Uterus and oviduct separated by a well-developed sphincter. Ovaries reflexed; oocytes arranged first in a single row, then in double rows and in multiple rows at growth region.

Tail elongate, filiform, with rounded tip, 268 µm or 6.6 anal body-widths long. Caudal pores indistinct.

Male: Similar to female in general shape and morphology except for the tail shape and the male reproductive system. Odontostyle 60 µm or three times the lip region-width. Odontophore 60 µm or equal to the odontostyle length. Male reproductive system typical to the genus. Supplements consist of an adanal pair and a series of 26 contiguous ventromedians. The first ventromedian supplement situated 2 anal body-widths from cloacal opening. Spicules 110 µm or 2.7 anal body-widths long medially. Lateral guiding pieces 13 µm long. Prerectum 400 µm or 10 anal body-widths long. Tail bluntly rounded, 28 µm or 0.7 anal body-width long, with 5 caudal pores on each side.

Type habitat and locality: Soil around roots of paddy, Oryza sativa, at Baraibari, district Coochbehar, West Bengal, India.

Type specimen: Holotype female along with one paratype male mounted on slide No. WN 519; collected by Dr. Q. H. Baqri in November 1984.

Differential diagnosis: Laimydorus distinctus sp. n. comes

close to L. grassoides (Jagerskiold, 1908) Siddiqi, 1969 in having three head widths long odontostyle. However, the present new species differs from L. grassoides in having different body dimensions (L = 2.8-3.7 mm, a = 26; b = 4.3; c = 20.6 in L. grassoides, after Thorne, 1939). Moreover, the present species has much wider lip region, straight tail tip in female and more number of ventromedian supplements in male (lip region much narrower than adjoining body; tail tip bent ventrally; hook-shaped and fifteen ventromedian supplements in L. grassoides).

Leimyiorus oryzae sp. n.
(Fig. 2)

Measurements:

Holotype female : L = 4.1 mm; a = 69.9; b = 7.8; c = 20.9; V = $^{9}44^{9}$.

Paratype female (4): L = 3.9-4.4 mm; a = 66.71; b = 7.9-8.5; c = 18.7-26; V = $^{8-10}42.46^{9}$

Paratype male (4) : L = 3.5-3.7 mm; a = 60-71; b = 6.9-7.2; c = 175-210; T = 51-53

Description :

Female: Body slightly ventrally curved posterior to the vulva upon fixation, and tapering towards both ends. Cuticle finely striated, 1-4 µm thick (thickest on tail). Lateral hypodermal chords 1/4-1/3 of body-width near middle. Dorsal, ventral and lateral body pores indistinct. However, in one female five dorsal pores in anterior region and twentysix lateral pores upto vulva region have been counted.

Lip region marked by a constriction, slightly wider than adjoining body, about 1/2.5 of body-width at base of oesophagus. Amphids stirrup-shaped; their apertures occupying 5-6 μm or 32-36% of the corresponding body-width and 6-7 μm from anterior end. Sensillar pouches 14-16 μm from amphidial apertures.

Odontostyle 25-27 μm or 1.6-1.8 lip region-widths long; aperture 8-9 μm or 30-36% of the odontostyle length. Guiding ring 14-16 μm or about one lip region-width long from anterior end. Odontophore 29-32 μm or 1.1-1.2 times the odontostyle length. Location of oesophageal gland nuclei and their orifices are as follows : DO = 48.0-51.1; DN = 48.7-52.6; DO-DN =0.7-1.5; S_1N_1 = 64.2-67.9; S_1N_2 = 71.9-73.5; S_2N = 85.0-86.8; S_2O = 87.5-88.0; K = 67.5-71.9; K' = 69.7-73.7.

Nerve ring at 132-145 μm or 25-29% of the neck region. Cardia tongue-shaped, 22-25 μm, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 339-460 μm or 12-15 times the anal body-width. Rectum 30-37 μm or about 1.0-1.2 anal body-width long.

Vulva a longitudinal slit. Vagina 20-22 μm or 33-36% of the corresponding body-width. Female reproductive system amphidelphic. Uterus and oviduct separated by a sphincter. Ovaries reflexed; oocytes arranged in a single row, then double rows and multiple rows at the growth region.

Tail elongate, conoid, 150-260 μm or 5.3-8.6 anal body-widths long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except for the curved posterior region, tail shape and reproductive system. Odontostyle 24-26 µm or 1.7-1.8 lip region-widths long; aperture 7-8 µm or 29-32% of the odontostyle length. Odontophore 30-32 µm or 1.2 odontostyle length. Gonads typical. Sperms elliptical, 3-7 µm long. Supplements consist of an adanal pair and 18-22 ventromedians. The first ventromedian supplement situated at about 2.5 anal body-widths from cloacal opening. Subventral papillae 8-10, irregularly spaced. Spicules measure 55-59 µm along the curved median line or nearly two anal body-widths long. Lateral guiding pieces 10-12 µm long. Prorectum 302-360 µm or 10.4-12.4 anal body-widths long. Tail bluntly conoid, 18-20 µm or less than one anal body-width long, with 2-3 caudal pores on each side.

Type habitat and locality: Soil around roots of paddy Oryza sativa, at Salbari, district Darjeeling; West Bengal, India.

Type specimen: Holotype female mounted on slide WN 520, three paratype females with other females on slide WN 521, one paratype female alongwith three paratype males on slide WN 522 and three paratype males mounted on slide WN 523; collected by Dr. Q. H. Baqri in November, 1983.

Differential diagnosis : Laimydorus oryzae sp. n. resembles Laimydorus pseudostagnalis (Micoletzky, 1927) Siddiqi, 1969; L. stenocyrus (Andrássy, 1968) Siddiqi, 1969 and L. cryptosmarus (Loof, 1968) Baqri & Coomans, 1973, in having a

well offset lip region and 1.6-1.8 head-widths long odontostyle. It differs from L. pseudostagnalis in having normal size of labial papillae and shorter tail in female; less number of ventromedian supplements in male (labial papillae well developed modifying the shape of the lip, c = 13 in female and male with 25 ventromedian supplements in L. pseudostagnalis). From L. stenocyrus it differs in having a longer and thinner body, shorter tail in female and more number of ventromedian supplements in male (L = 1.9-2.2, a = 33-38; c = 11.1-11.5 and male with 28-29 ventromedian supplement in L. stenocyrus). It is longer and thinner than L. cryptosperma, with shorter tail (L = 1.94-2.30 mm; a = 28-38; and c = 10-12 in L. cryptosperma).

Thornenema nodicaudatum sp. n.
(Fig. 3)

Measurements:

Holotype female : L = 0.90 mm; a = 25.1; b = 4.5; c=17.7; V = $^{17}_{53}$17

Paratype females (6): L = 0.85-1.07 mm; a = 24.2-26.9; b = 4.2-5.2; c = 16.8-21.6; V = $^{14-18}_{50-53}$13-16

Paratype males (4) : L = 0.80-0.87 mm; a = 22.4-25.8; b = 4.0-4.4; c = 38.0-42.7; T = 51-60

Description :

Female: Body slightly curved ventrally upon fixation. Cuticle with fine transverse striations, 1.5-3 µm thick (thickest on tail). Lateral hypodermal chords 1/4-1/3 of body-width near middle. Dorsal, ventral and lateral body pores not distinct, only 3-4 lateral body pores visible in prerectum region.

Lip region slightly narrower than adjoining body; post labial sclerotization absent, cheilostome slightly sclerotised. Amphids stirrup-shaped; their apertures occupying 40-50% of corresponding body-width. Odontostyle 10-11 µm or 1.0-1.1 head-width long; aperture 4 µm or 36-40% of the odontostyle length. Guiding ring 6-7 µm or 0.6-0.7 lip region width from anterior end. Odontophore 12-14 µm or 1.2-1.3 times the odontostyle length. Basal expanied part of oesophagus 33-34% of the total oesophagus. Location of the oesophageal gland nuclei and their orifices are as follows : DO = 67.5-68.6; DN = 68.8-71.4; DO-DN = 1.3-3.1; S_1N_1 = 76. 1-78.5; S_1N_2 = 83.2-84.1; S_2N = 89.9-90.8; S_2O = 91.9-92.6; K = 48.4-53.8; K' = 57.1-61.2.

Nerve ring 87-95 µm or 40-43% of the neck region from anterior extremity. Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum 40-45 µm or 2.3-3.0 anal body-widths long.

Vulva a transverse slit. Vagina about 1/3-1/2 of corresponding body-width; slightly sclerotized distally; encircled by sphincter muscles. Female reproductive system amphidelphic, Both the sexual branches equally well developed. Uterus and oviduct separated by a very weak sphincter. Sperms present in the uteri and oviduct.

Tail digitate, elongate, gradually tapering to a narrow rounded tip; 50-55 µm or 2.6-3 anal body-widths long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except for the tail and the genital system. Odontostyle 9-10 µm or one head-width long; aperture 4 µm or 40% of the odontostyle length. Odontophore 12-14 µm or 1.3-1.4 times the odontostyle length. Male genital system typical to the genus. Sperms elliptical, 2-5 µm long. Spicules 36-38 µm or 1.4-1.5 anal body-width long when measured along the curved median line. Lateral guiding pieces well developed, rod-shaped, 6 µm long. In addition to the adanal pair, 7-8 regularly spaced ventromedian supplements present. The first ventromedian supplement situated at 1.9-2.2 anal body-width from cloacal opening. Subventral papillae 2 -3 in number. Copulatory muscles reaching upto the last supplement. Prerectum 1.6-1.9 anal body-widths long, restricted in the supplement region. Tail short, conoid, with broad rounded tip, 0.8 anal body-width long with two caudal pores on each side.

Type habitat and locality : Soil around roots of paddy Oryza sativa at Salbari, district Darjeeling, West Bengal, India.

Type specimen : Holotype mounted on slide WW 526, six paratype females alongwith two paratype males mounted on slide WW 527 and two paratype females with two paratype males mounted on slide WW 528; collected by Dr. Q. H. Baqri in November, 1983.

Differential diagnosis : Thornenema noticaudatum sp. n. resembles T. pseudosarbum Carbonell & Coomans, 1986 in having amphidelphic reproductive system, but differs from it in having

shorter body length, and odontostyle; more posteriorly situated vulva, two well developed sexual branches and a shorter female tail (L = 1.7-1.9 mm; odontostyle = 14-17 µm; V = 38-40; c = 10-12 in T. pseudosartum).

Thornenema conura sp. n.
(Fig. 4)

Measurements :

Holotype female : L = 1.34 mm; a = 33.6; b = 6.1; c = 10.1; V = $^{14}_{45}{}^{19}$

Paratype females (5): L = 1.29-1.41 mm; a = 29.3-32.1; b = 5.6-6.2; c = 10.2-11.3; V = $^{15-16}_{43-45}{}^{13-16}$

Paratype males (5): L = 1.19-1.29 mm; a = 28.2-32.3; b = 5.2-5.7; c = 53.9-58.7; T = 60-65.

Description :

Female : Body slightly ventrally curved upon fixation, tapering gradually towards both ends. Cuticle with fine transverse striations, 1.5-3.0 µm thick (thickest on tail). Lateral hypodermal chords about 1/4th of body-width near middle. Lateral, dorsal and ventral body pores indistinct.

Lip region well offset by a depression, narrower than adjoining body with flattened apex. Post labial sclerotisation present but not well developed. Amphids stirrup-shaped; their apertures 4-5 µm from anterior end and occupying about 42-44% of the corresponding body-width. Sensillar pouches 15-17 µm from the amphidial apertures. Odontostyle 11-13 µm or 1.2-1.4

lip region-widths long, apertures 4-5 µm or 30-38% of the odontostyle length. Guiding ring 8-9 µm or 0.8-0.9 head width from anterior end. Odontophore 16-18 µm or 1.2-1.5 times the odontostyle length. Basal expanded part of oesophagus about 38-42% of the total oesophageal length. Locations of oesophageal gland nuclei and their orifices are as follows : DO = 70.2-73.3; DN = 73.2-76.6; DO-DN = 3.0-3.3; S_1N_1 = 80.5-81.2; S_1N_2 = 87.0-87.1; S_2N = 88.1-91.2; S_2O = 92.9-93.7; K = 42.8-44.8; K' = 57.5-60.6.

Nerve ring at 97-100 µm or 41-42% of the neck region from anterior extremity. Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc absent. Prerectum about 60-70 µm or 2.7-2.9 anal body-widths long. Rectum 22-25 µm long.

Vulva a transverse slit. Vagina about 14-16 µm or 30-34% of the corresponding body-width. Female reproductive system amphidelphic, anterior and posterior sexual branches well-developed. Uterus and oviduct separated by a weak sphincter. Sperms present in the uteri. Ovaries reflexed, oocytes arranged in a single row, then in double rows and multiple rows in the growth region.

Tail elongate conoid tapering gradually to a narrow rounded tip, 5.4-5.8 anal body-widths long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology

except for the tail and the male genital system. Odontostyle 10-12 µm or 1.1-1.3 head-width long, aperture 4-5 µm or occupying 36-41% of the odontostyle length. Odontophore 16-18 µm or 1.3-1.7 times the odontostyle length. Male genital system typical to the genus. Spicules 36-40 µm or 1.4-1.7 anal body-widths long when measured along the curved median line. Lateral guiding pieces weakly developed, 6.7 µm long. Supplements weakly developed, consisting of one adanal and regularly spaced 12-14 ventromedians. The first ventromedian supplement situated at 2.2-2.3 anal body-widths from cloacal opening. Copulatory muscles reaching upto the last supplement. Prerectum 98-101 µm or nearly 4 anal body-widths long. Tail bluntly conoid, 21-24 µm or about one anal body-width long, with three caudal pores on each side.

Type habitat and locality: Soil around roots of paddy, Oryza sativa at Panditpur, district West Dinajpur, West Bengal, India.

Type specimen : Holotype female alongwith two paratype males mounted on slide WN 529, four paratype females with two paratype males mounted on slide WN 530, and one paratype female with two paratype males mounted on slide WN 531; collected by Dr. P. K. Das in May-June 1982.

Differential diagnosis: Thornenema conura sp. n. comes close to T. pseudosartum Carbonell & Coomans 1986 and T. nodicaudatum sp. n. in having amphidelphic reproductive system.

It differs from T. pseudosartum in having shorter body length, shorter odontostyle, more posteriorly situated vulva, fully developed anterior sexual branch and more number of ventromedian supplements in male (L = 1.70-1.95 mm; odontostyle = 14-17 µm; V = 38-40 and 7-10 supplements in T. pseudosartum). From T. nodicaudatum sp. n. it differs in having post labial sclerotisation, more anteriorly situated vulva, longer female tail and more number of supplements in male (only cheilostome sclerotised, V = 52-54, c = 16.7-19.9, 7-8 well developed ventromedian supplements in T. nodicaudatum).

Thornenema novum sp. n.
(Fig. 5)

Measurements :

Holotype female : L = 0.98 mm; a = 39.1; b = 4.0; c = 6.3; $V = {}^{9}_{48}{}^{11}$

Paratype females (4) : L = 1.0-1.16 mm; a = 35.7-40.3; b = 4.1-4.4; c = 5.9-7.8; $V = {}^{7-10}_{44-47}{}^{9-12}$

Paratype males (3) : L = 0.88-0.98 mm; a = 29.6-31.5; b = 3.8-4.0; c = 46.4-49.0; T = 53-57

Description :

Female : Body almost straight upon fixation, tapering slightly towards both ends. Cuticle finely striated, 1-3 µm thick (thickest on tail). Lateral hypodermal chords 1/5-1/4 of body-width near middle. Dorsal, ventral and lateral body pores indistinct.

Lip region marked by a slight depression, cheilostome moderately sclerotised, with amalgamated lips bearing the usual number of papillae. Amphids stirrup-shaped, their apertures occupying 4-5 μm or about 33-35% of the corresponding body-width. Odontostyle 11-12 μm or 1.2-1.3 lip region-widths long; aperture 4-5 μm on 36-41% of the odontostyle length. Guiding ring 7-8 μm or 0.7-0.9 lip region-width from anterior end. Odontophore 15-17 μm or 1.2-1.5 times the odontostyle length. Basal expanded part of oesophagus 38-40% of the total oesophageal length. Locations of the oesophageal gland nuclei and their orifices are as follows: DO = 60.2-61.4; DN = 62.0-63.4; DO-DN = 1.8-2.0; S_1N_1 = 74.8-75.5; S_1N_2 = 78.7-81.6; S_2N = 91.0-93.5; S_2O = 93.3-94.3; K = 66.6-76.1; K' = 70.0-78.7.

Nerve ring at 83-98 μm or 33-38% of the neck region from anterior extremity. Cardia tongue-shaped, enveloped by intestinal tissue. Oesophago-intestinal disc present. Prerectum about 40-45 μm or 2.3-2.6 anal body-widths long. Rectum 20-25 μm or 1.1-1.4 anal body-widths long.

Vulva a transverse slit. Vagina about 12-14 μm or nearly 1/2 of the corresponding body-width. Female reproductive system amphidelphic, but the anterior sexual branch is weakly developed. A weak sphincter is present between the uterus and oviduct. Sperm not seen. Oocytes arranged in single row, then in double rows and multiple rows at the growth region.

Tail long, filiform, measuring 155-177 μm or 9.1-10.4 anal body-widths, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except for the tail and genital system. Odontostyle 10-11 µm or one head-width long; aperture occupying 4 µm or 39-40% of the odontostyle length. Odontophore 14-15 µm or 1.3-1.5 times the odontostyle length. Male reproductive system typical to the genus. Spicules 45-50 µm or 2.0-2.1 anal body-widths long when measured along the curved median line. Lateral guiding pieces 7 µm, rod-shaped. In addition to the adanal pair, seven irregularly spaced ventromedian supplements present. The first ventromedian supplement situated nearly two anal body-width from cloacal opening. Subventral papillae four in number. Copulatory muscles reaching beyond the last ventromedian supplement. Prorectum 55-70 µm or 2.5-3 anal body-widths long. Tail short, bluntly rounded, 22-23 µm or about one anal body-width long, with 7-8 caudal pores on each side.

Type locality and habitat : Soil around roots of paddy Oryza sativa from Tashiding, district Darjeeling, West Bengal, India.

Type Specimen: Holotype female and one paratype male mounted on slide WW 532, two paratype females alongwith two paratype males and two juveniles mounted on slide WW 533; two paratype females with two juveniles mounted on slide WW 534; collected by Dr. Q. H. Baqri in November 1983.

Differential diagnosis : Thornenema novum sp. n. comes close to T. paucidosatum Carbonell & Coomans, 1986, T. conura sp. n., and T. nodicaudatum sp. n. in having amphidel-

phic reproductive system. However it differs from T. pseudosartum in having shorter body, longer tail, only moderately sclerotised cheilostome and shorter odontostyle (L = 1.7-1.9 mm; c =10-12, well-developed post labial sclerotisation and 14-17 µm long odontostyle in T. pseudosartum). From T. conura sp. n. it differs in the absence of post-labial sclerotisation; in having longer tail in female and less number of supplements in male (post labial sclerotisation present, c = 10.3-11.3, 12-14 weak ventromedian supplements in T. conura). It differs from T. nodicaudatum in the presence of slight labial sclerotisation, anteriorly situated vulva, longer female tail (absence of labial sclerotisation, V = 52-54 and c = 5.9-7.8 in T. nodicaudatum). Moreover, it differs from T. conura and T. nodicaudatum in having weakly developed anterior gonad.

SUMMARY

Three new species of Laimydorus Siddiqi, 1969 belonging to the family Dorylaimidae, and three new species of Thornenema Andrássy, 1959 under the family Thornenematidae have been described from North Bengal districts of West Bengal. Laimydorus distinctus sp. n. is distinct in having L = 5.05-6.44 mm; odontostyle 60-62 µm, odontophore about one odontostyle length and female tail 6.6 anal body-widths long. L. oryzae sp. n. is characterised by L = 3.98-4.40 mm; odontostyle = 25-27 µm, odontophore 1.1-1.2 times the odontostyle length and female tail 5.3-8.6 anal body-widths long. L. janai sp. n. can be

distinguished from all closely related species by L = 2.52-3.34 mm; odontostyle 20-22 µm long having thinner lumen, odontophore 1.1-1.3 times the odontostyle length and female tail 6.0-6.8 anal body-widths long. Thornenema neilcauiatum sp. n. is characterised in having L = 0.80-1.07 mm; odontostyle 10-11 µm long, odontophore 1.2-1.3 times the odontostyle length female tail 2.6-3.0 anal body-widths long. T. conura sp. n. is 1.2-1.4 mm long, odontostyle 11-13 µm long odontophore 1.2-1.5 times the odontostyle length and female tail 5.4-5.8 anal body-widths long. T. novum sp. n. is characterised by L = 0.88-1.16 mm, odontostyle 11-12 µm long, odontophore 1.2-1.5 times the odontostyle length and 9.1-10.4 anal body-widths long female tail.

ACKNOWLEDGEMENTS

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LEGENDS

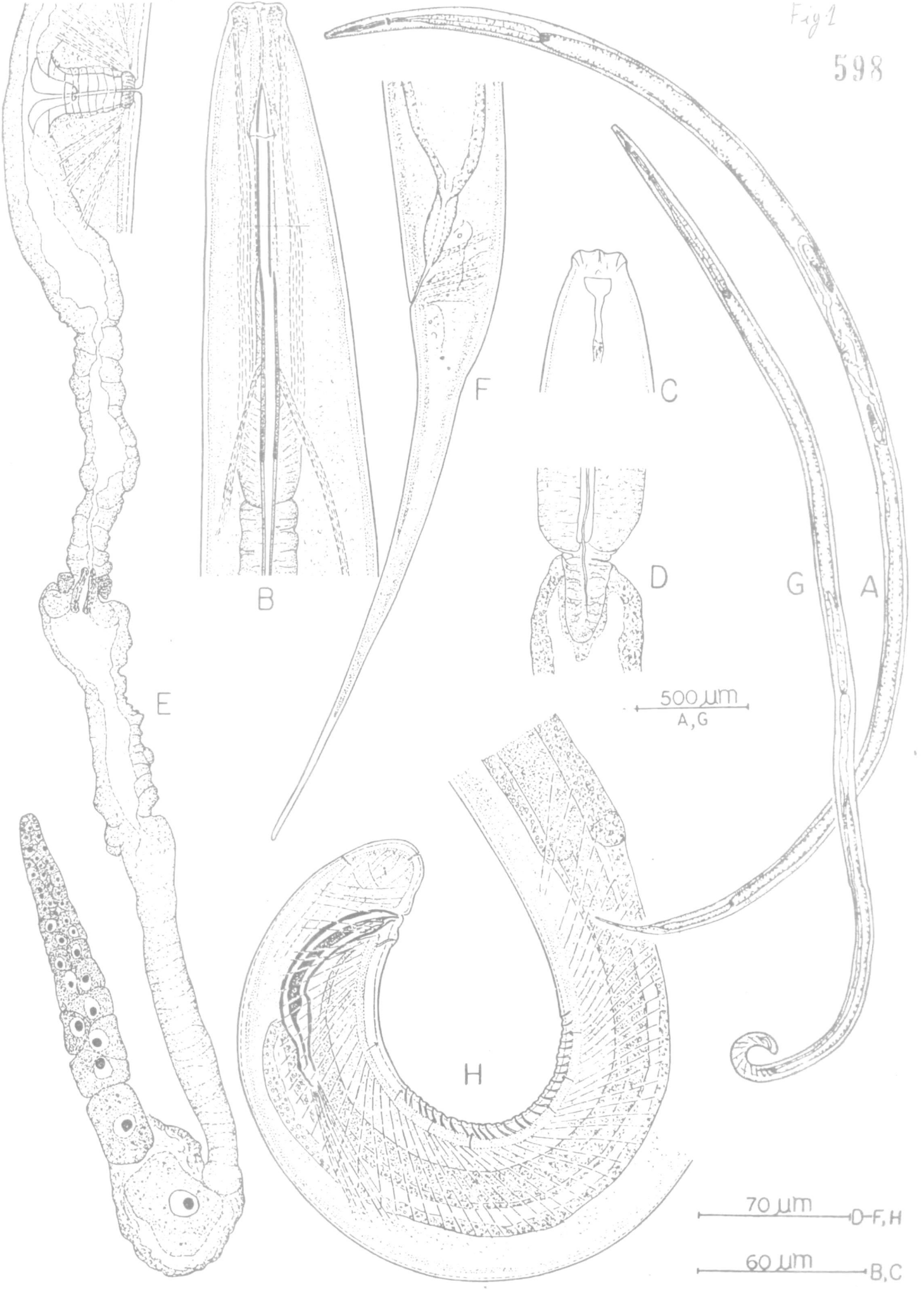
Fig. 1 Laimydorus distinctus sp. n. A-F : Female. A-Entire Female; B-Anterior region, C-Anterior region showing amphid, D-Oesophago-intestinal junction, E-Female reproductive system, F-Female tail, G-H: Male. G-Anterior male, H-Male tail.

Fig. 2 Laimydorus oryzae sp. n. A-G: Female. A-Entire female, B-Anterior end, C-Anterior end showing amphid, D-Basal part of oesophagus, E-Female reproductive system, F-Female tail tip broken at early stage of development, G-Female tail. H-I: Male. H-Entire male, I-Male tail.

Fig. 3 Thornenema noticaudatum sp. n. A-F: Female. A-Entire female, B-Anterior region, C-Basal part of oesophagus, D-Anterior end showing amphid, E-Female reproductive system, F-Female tail. G-H: Male. G-Entire male, H-Male male.

Fig. 4 Thornenema conura sp. n. A-F: Female. A-Entire female, B-Anterior region, C-Anterior end showing amphid, D-Female reproductive system, E-Female tail, G-H: Male. G-Entire male, H-Male tail

Fig. 5 Thornenema novum sp. n. A-E: Female. A-Entire female, B-Anterior region, C-Anterior end showing amphid, D-Female reproductive system, E-Female tail, F-G: Male. F-Entire male, G-male tail.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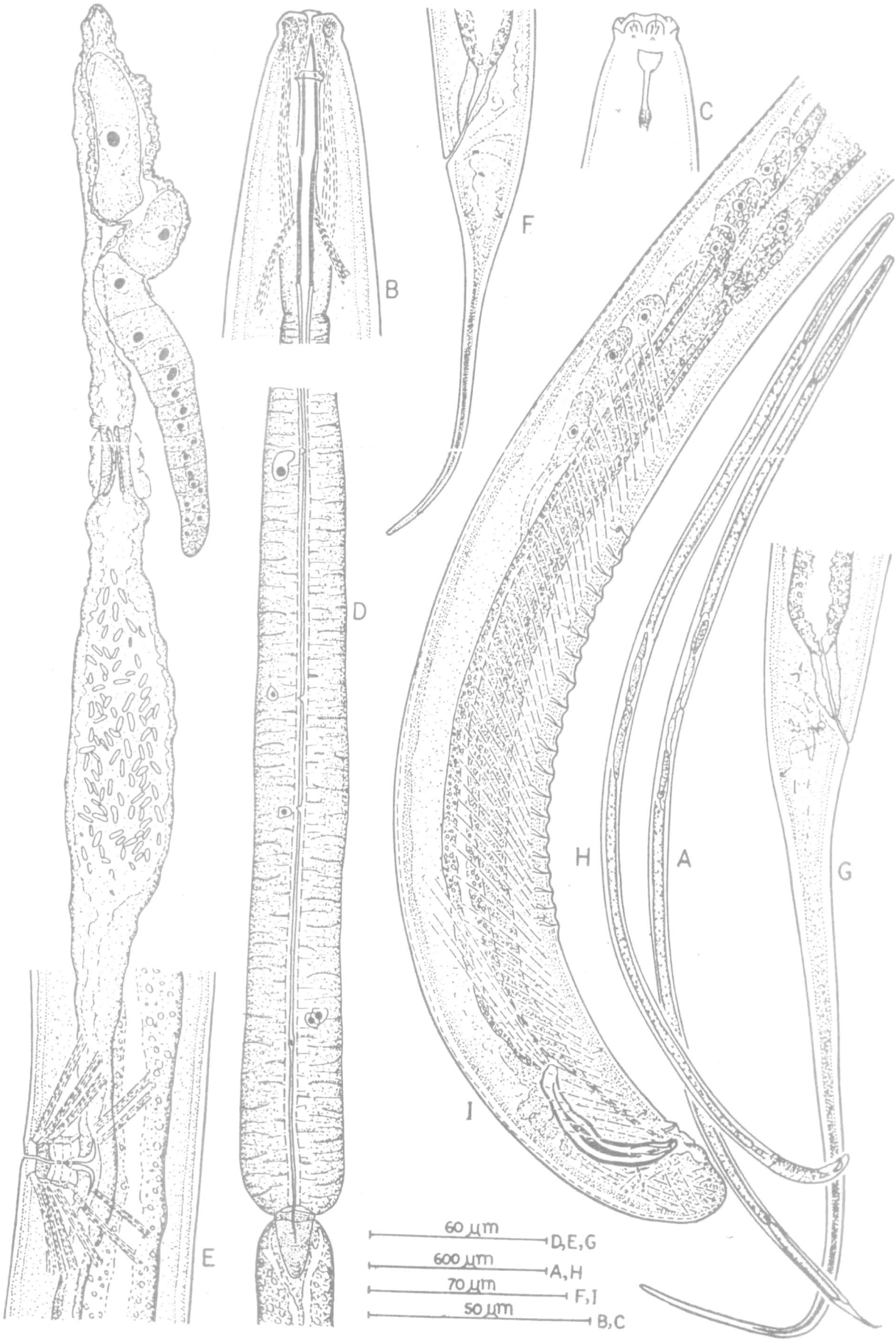
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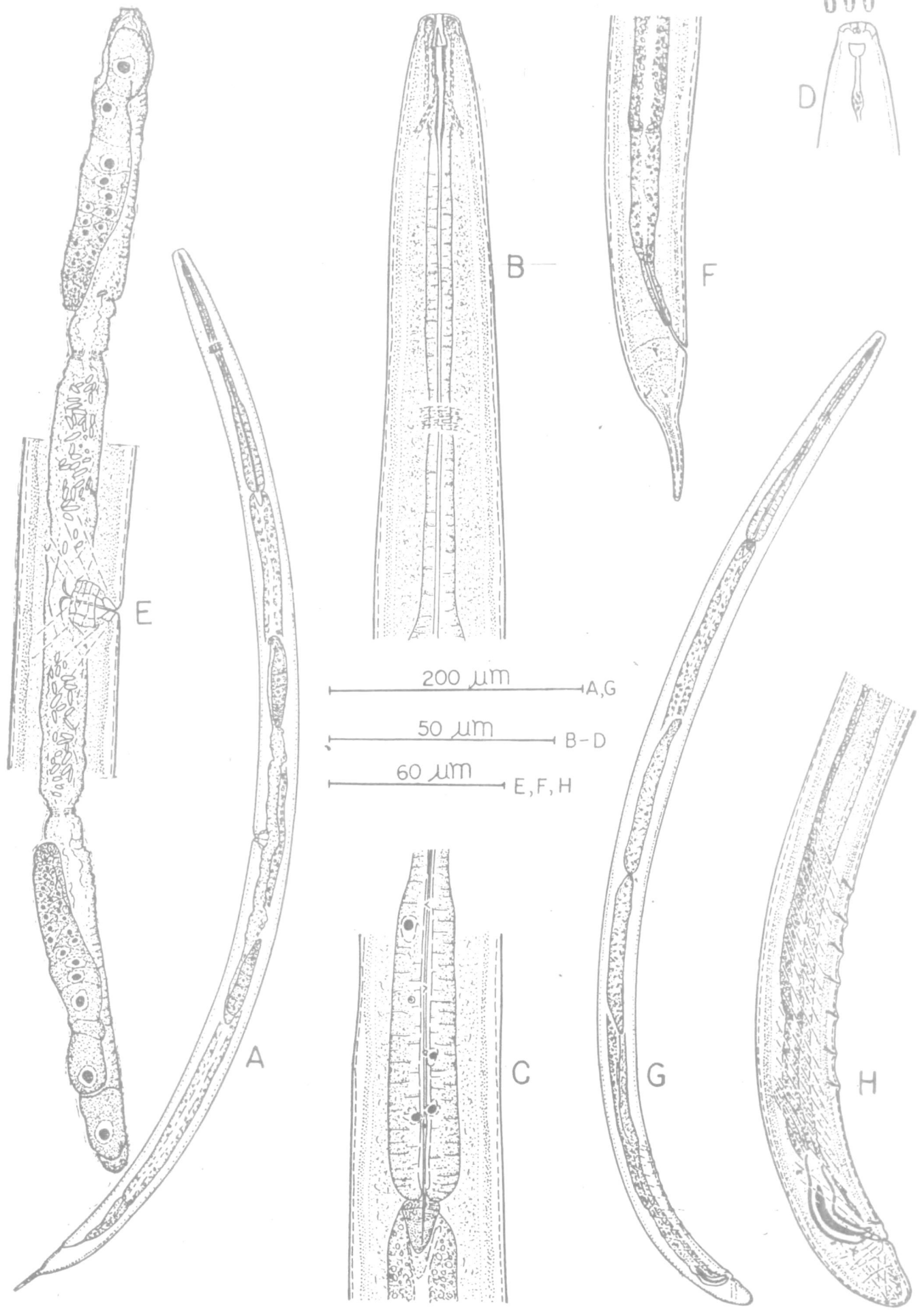
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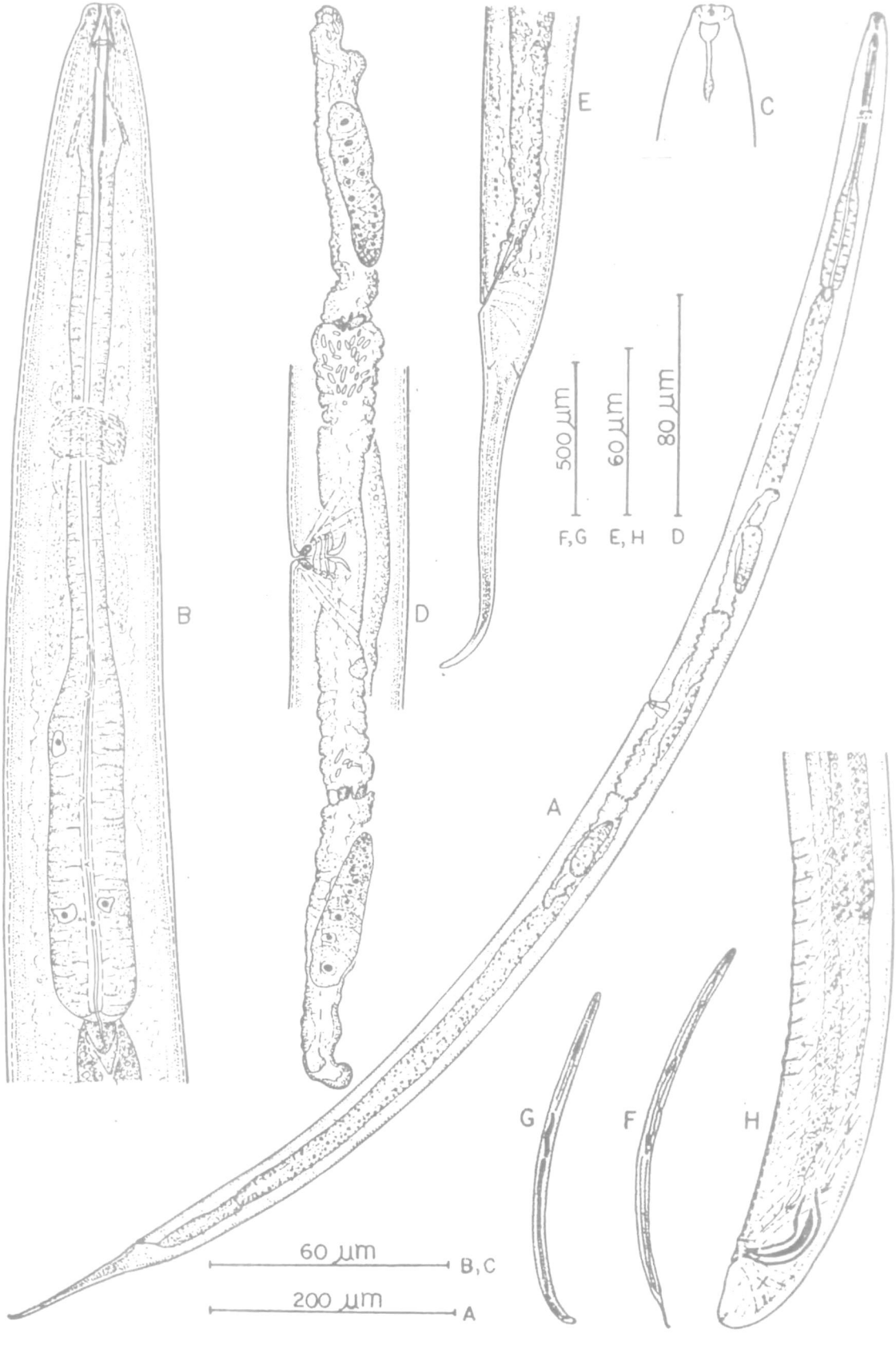
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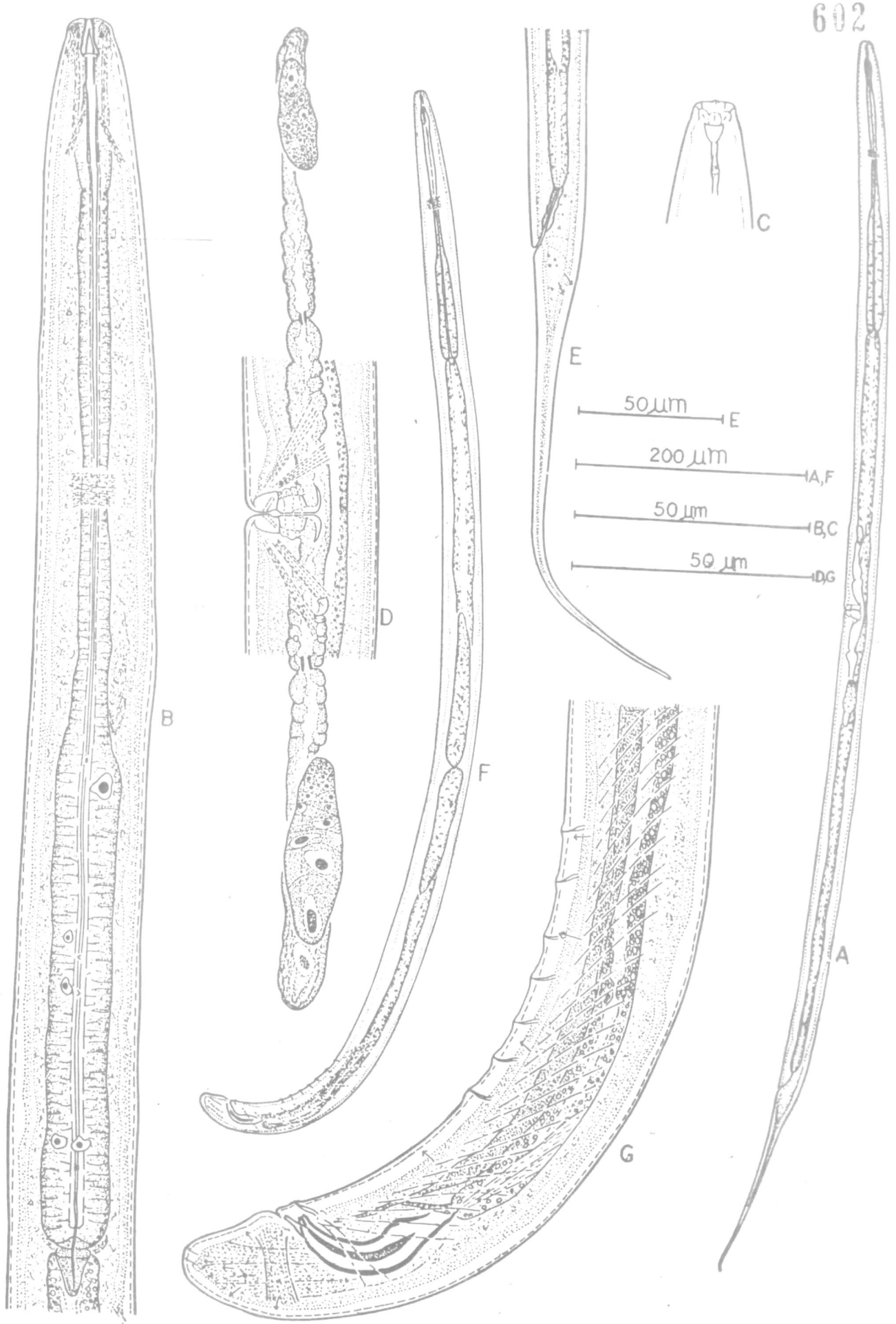
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NEMATODES FROM WEST BENGAL (INDIA). XXII

MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN *HIRSCHMANNIELLA ORYZAE* (V. BREDA DE HAAN, 1902) Luc & GOODEY, 1963 (RADOPHOLIDAE : TYLENCHIDA : NEMATODA)

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INTRODUCTION

Though *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 has been found a key pest of paddy by Baqri *et al.* (1983) in West Bengal, *H. oryzae* (V. Breda de Haan, 1902) Luc & Goodey 1963 has also been encountered as a potential pest of paddy in some localities of North Bengal Districts of West Bengal. Since *H. gracilis* has been confused with *H. oryzae* in West Bengal, it was felt necessary to study the intra-specific variations with special reference to allometric and morphometric characters of the two species so that these may be identified correctly. Dey & Baqri (1985) have already discussed the allometric and morphometric variations in *H. gracilis*. Waliullah (1985) has also studied allometric variations in *H. oryzae* from Indonesia. However, he has taken into consideration only the linear relationships of a few sets of characters by using the logarithmic regression equation. This paper reports the variations in a single population of *H. oryzae* from West Bengal, India.

MATERIAL AND METHOD

The nematodes were fixed in hot 4% formalin, dehydrated in the desiccator and mounted in anhydrous glycerine. The specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

HISCHMANNIELLA ORYZAE (V. Breda de Haan, 1902) Luc & Goodey, 1963
(Figs. 1-3)

DIMENSIONS : TABLE - I

DESCRIPTION :

FEMALE : Body slightly curved upon fixation. Body annules 1.2-2.0 µm apart in the middle region. Lateral fields 5-7 µm or 1/4th-1/3rd of body width near middle, marked with four incisures of which the outer ones are crenate. In some specimens incomplete aerolations have been found in the posterior region of the body. Head continuous with body, flat at apex, marked with 3-4 annules, with well-developed cephalic framework. Stylet robust, 17-19 µm or about 1.8-2.2 times the head width. The metenchium (anterior part of the stylet) 7-8 µm long or 41-42% of the stylet length. The stylet knobs are rounded, 3.5-4.2 µm wide.

Oesophagus typical to the genus. Median oesophageal bulb at 56-60% of the oesophageal length from anterior end, 16-20 x 9-12 µm. Oesophageal glands lobed, overlapping intestine ventrally. Orifice of the dorsal oesophageal gland 2.5-3.5 µm below the base of the stylet. The nerve ring situated at

89-102 µm or 72.8% of the oesophageal length from anterior extremity. Excretory pore at 112-131 um or 91-94% of the oesophageal length from anterior end, located slightly anterior to the oesophago-intestinal junction (fig. 1). Hemizonid 3-4 annules long, situated 0-5 annules anterior to the excretory pore. Vulva post-equatorial in position. Vagina about 1/2 of the corresponding body-width. Reproductive system amphidelphic. Each sexual branch consists of an uterus, a spermatheca, an oviduct and an ovary. Spermatheca filled with sperms. Oocytes arranged in a single row except in the growth region. Tail cylindrical, with mucronate terminus, 70-105 µm or 5.5-6.5 anal body-widths long. Phasmids located in posterior half of the tail, 26.4-42.8% of the tail length from tail terminus.

Male : Similar to female in general shape and morphology except the reproductive system and the tail shape. Bursa sub-terminal (fig.1). Gubernaculum slightly curved. Spicules 20-28 µm long when measured along the median line. Tail slightly curved, 63-90 µm or 4.5-6 anal body-widths long, with a pointed ventral mucro.

MORPHOMETRIC AND ALLOMETRIC CHARACTERS

The measurements and statistical analyses of various morphometric and allometric characters of adult females and males have been furnished in Table-I. The position of the vulva and the length of the tail are significantly correlated with the body length, the correlation of which are 0.922 and 0.629 respectively (fig. 2). The position of the excretory pore has

moderate correlation with body length as its 'r' value is 0.502. The length of oesophagus and the position of the median bulb from anterior end is less correlated with the body length, the 'r' value of which are 0.368 and 0.169 respectively. The length of the stylet and gonads have no correlation with the body length.

The statistical analysis shows that the stylet length and the 'V' value are the least variable characters (CV < 3). Though the 'V' value is least variable, the length of anterior and posterior sexual branches exhibit high degree of variability (CV = 8.64 and 10.5 respectively). The length of body, tail and oesophagus; distance of dorsal oesophageal gland opening from the base of stylet; position of median bulb, nerve ring, and excretory pore from anterior end; and the values of a, b, b', c, D and m are moderately variable characters (CV = 4-8). In case of the male the length of the spicules varies moderately (CV = 6.94) while the length of the gubernaculum and the position of phasmids show a high degree of variability(CV=16.16).

In some respects these results have been found similar to Waliullah's (1985) findings on H. oryzae, viz., total oesophageal length, position of vulva and spicule length show consistent positive correlation with body length. Our observations are similar to those of Bird and Mai (1967) who found that the stylet length and the position of vulva were least variable than other allometric characters in Trichodorus christei Allen, 1957. Azmi and Jairajpuri (1976) also found that the

position of vulva and the length of the stylet are least variable characters in Helicotylenchus indicus Siddiqi, 1963. Similar results have been found by Baqri & Ahmad (1981, 1984) in Helicotylenchus arenacauda Sher, 1966 and Tylenchorhynchus nudus Allen, 1955, and Dey & Baqri (1986) in Hirschmanniella gracilis.

Remarks : Dey & Baqri (1985) while discussing the distinguishing characters of H. gracilis and H. oryzae have already reported that the length of the stylet and spicules can be used to differentiate these two species (stylet and spicules = 21-23 µm and 26-35 µm in H. gracilis, against 17-19 µm and 20-23 µm respectively in H. oryzae). The present study further confirms that the position of excretory pore is a moderately variable character and the presence or absence of aerolations in the lateral fields is not a reliable character.

Sher (1968) in his illustration (fig. 3,A) and Sivakumar & Khan (1982) in their key to species of Hirschmanniella have reported that the excretory pore in H. oryzae is situated posterior to oesophageal junction. However, the West Bengal population shows that the position of excretory pore varies from opposite to slightly anterior to the oesophago-intestinal junction.

Locality and habitat : From soil around roots of paddy, Oryza sativa at Salbari, District Darjeeling, West Bengal.

SUMMARY

The statistical analys s of the measurements of a single population of Hirschmanniella oryzae (V. Breda de Haan, 1902) Luc & Goodey, 1963 reveal that the length of the stylet and the position vulva are the least variable characters (CV< 3). The length of the body, oesophagus, tail ani spicules; the position of the dorsal oesophageal glands opening, median oesophageal bulb, nerve ring, excretory pore and the values of a, b, b', c, c and m are moderately variable characters (CV< 8). The values of G_1 and G_2, length of the oesophageal overlap and the position of the phasmids show a high degree of variability (CV > 8).

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, for providing necessary research facilities. The first author is also indebted to the Zoological Survey of India for the financial assistance in the form of Senior Research Fellowship.

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TABLE -I

MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN ADULTS OF *HIRSCHMANNIELLA ORYZAE* (v. BREDA DE HAAN, 1902) LUC & GOODEY, 1963 (40 FEMALES, 40 [illegible]

Characters	FEMALES Range	Mean ± S.D.	S.E.	C.V. (%)	MALES Range	Mean ± S.D.	S.E.	C.V. (%)
Length (mm)	1.20 - 1.58	1.40 ± 0.09	0.02	6.83	1.09 - 1.44	1.28 ± 0.09	0.01	7.0
a	59.20 - 75.90	68.05 ± 3.38	0.53	4.97	55.80 - 73.94	63.71 ± 5.05	0.80	7.92
b	10.60 - 12.70	11.53 ± 0.60	0.09	5.20	9.01 - 11.68	10.53 ± 0.67	0.11	6.39
b'	3.9 - 5.0	4.32 ± 0.24	0.04	5.55	3.67 - 5.02	4.19 ± 0.25	0.04	6.03
c	14.20 - 18.30	16.29 ± 0.98	0.15	6.02	14.34 - 18.21	16.60 ± 1.01	0.16	6.11
c'	5.20 - 7.0	5.82 ± 0.47	0.07	8.07	4.5 - 6.15	5.31 ± 0.35	0.06	6.64
V /T	51 - 57	53.42 ± 1.41	0.22	2.64	23 - 35	28.97 ± 3.35	0.53	11.55
Q_1	18 - 23	20.02 ± 1.73	0.27	8.64	--	--	--	--
Q_2	15 - 25	18.85 ± 1.98	0.31	10.5	--	--	--	--
O	13.51 - 18.42	15.57 ± 1.13	0.17	7.26	11.11 - 17.65	15.06 ± 1.12	0.17	7.44
m	55.30 - 66.10	61.82 ± 2.80	0.44	4.53	56.0 - 66.94	62.82 ± 2.12	0.34	3.38
Cut. at mid body (µm)	0.80 - 1.20	0.95 ± 0.10	0.02	10.50	0.8 - 1.2	0.94 ± 0.11	0.02	11.68
Annules (µm)	1.20 - 2.0	1.56 ± 0.23	0.04	14.68	1.1 - 1.7	1.47 ± 0.16	0.02	10.77
Lateral fields (µm)	5 - 7	5.87 ± 0.85	0.13	14.47	5 - 7	5.47 ± 0.60	0.09	10.92
Head width (µm)	7 - 9	8.47 ± 0.55	0.09	6.49	8 - 9	8.42 ± 0.50	0.08	5.93
Stylet (µm)	17 - 19	17.78 ± 0.48	0.08	2.69	17 - 19	17.50 ± 0.52	0.08	2.96
Head height (µm)	3 - 5	3.87 ± 0.40	0.66	10.32	3 - 5	3.75 ± 0.44	0.07	11.68
Stylet knobs (µm)	3.5 - 4.2	3.81 ± 0.10	0.01	2.62	3 - 4	3.81 ± 0.09	0.01	2.56
Metenchium (µm)	7 - 8	7.47 ± 0.19	0.02	2.54	7 - 8	7.52 ± 0.21	0.03	2.79
D. oeso. gl. opening (µm)	2.5 - 3.5	3.14 ± 0.23	0.03	7.32	2 - 3	2.84 ± 0.20	0.03	7.04
Oesophagus* (µm)	116 - 136	124.90 ± 4.34	0.69	3.47	113 - 135	123.35 ± 4.85	0.77	3.93
Oeso. overlap** (µm)	150 - 240	203.27 ± 19.78	3.13	9.73	140 - 205	185.20 ± 21.27	3.36	11.48
Median bulb (µm)	16-20 x 9-12	18.07 x 10.97 ± 1.11 x 0.89	0.18 x 0.14	6.18 x 8.12	17-20 x 8-11	18.10 x 9.87 ± 1.17 x 0.65	0.19 x 0.10	6.48 x 6.55
Median bulb* (µm)	70 - 81	75.20 ± 2.32	0.37	3.09	70 - 84	76.50 ± 3.49	0.55	4.57
Nerve ring* (µm)	89 - 102	96.42 ± 3.07	0.49	3.18	90 - 104	97.62 ± 3.58	0.57	3.67
Excretory pore* (µm)	112 - 131	121.45 ± 4.92	0.78	4.05	109 - 129	120.52 ± 5.01	0.79	4.16
Hemizonid (from excr. pore)	0 - 5 annules							
Hemizonid width	2 - 4 annules							
Vulva* (µm)	668 - 830	751.07 ± 46.0	7.27	6.12	--	--	--	--
Vagina (µm)	8 - 10	8.82 ± 0.81	0.13	9.18	--	--	--	--
Vulva body width (µm)	17 - 25	20.70 ± 1.80	0.28	8.7	--	--	--	--
Anterior gonad (µm)	222 - 380	279.15 ± 37.32	5.90	13.37	--	--	--	--
Posterior gonad (µm)	210 - 359	266.32 ± 37.34	5.90	14.02	--	--	--	--
Anal body width (µm)	12 - 18	14.87 ± 1.53	0.24	10.35	13 - 17	14.3 ± 2.54	0.40	17.78
Rectum (µm)	8 - 15	10.32 ± 2.16	0.34	20.96	--	--	--	--
Tail annules (no.)	54 - 75	65.27 ± 6.10	0.96	9.35	--	--	--	--
Tail length (µm)	70 - 105	86.47 ± 6.98	1.10	8.08	63 - 90	77.67 ± 5.34	0.84	6.87
Spicules (µm)	--	--	--	--	20 - 28	23.8 ± 1.65	0.26	6.94
Gubernaculum (µm)	--	--	--	--	5 - 10	7.7 ± 1.24	0.20	16.16
Phasmids (µm)	20 - 45	28.65 ± 5.65	0.89	9.72	21 - 35	27.67 ± 2.90	0.46	10.49

* Distance from anterior end

** Distance from Oesophagho -intestinal junction

LEGENDS

Fig. 1. Hirschmanniella oryzae (V. Breda de Haan, 1902) Luc & Goodey, 1963. A-G : Female. A- Entire female, B-D- Anterior region, E-Female reproductive system, F & G- Female tails. H-L-Male. H-Entire male, I & J-Male tails, K-Anterior region, L-Posterior region.

Fig. 2. Correlation between body length versus vulva, excretory pore and tail length respectively with regression lines.

Fig. 3. Correlation between body length versus oesophagus, position of median bulb and stylet length respectively with regression lines.

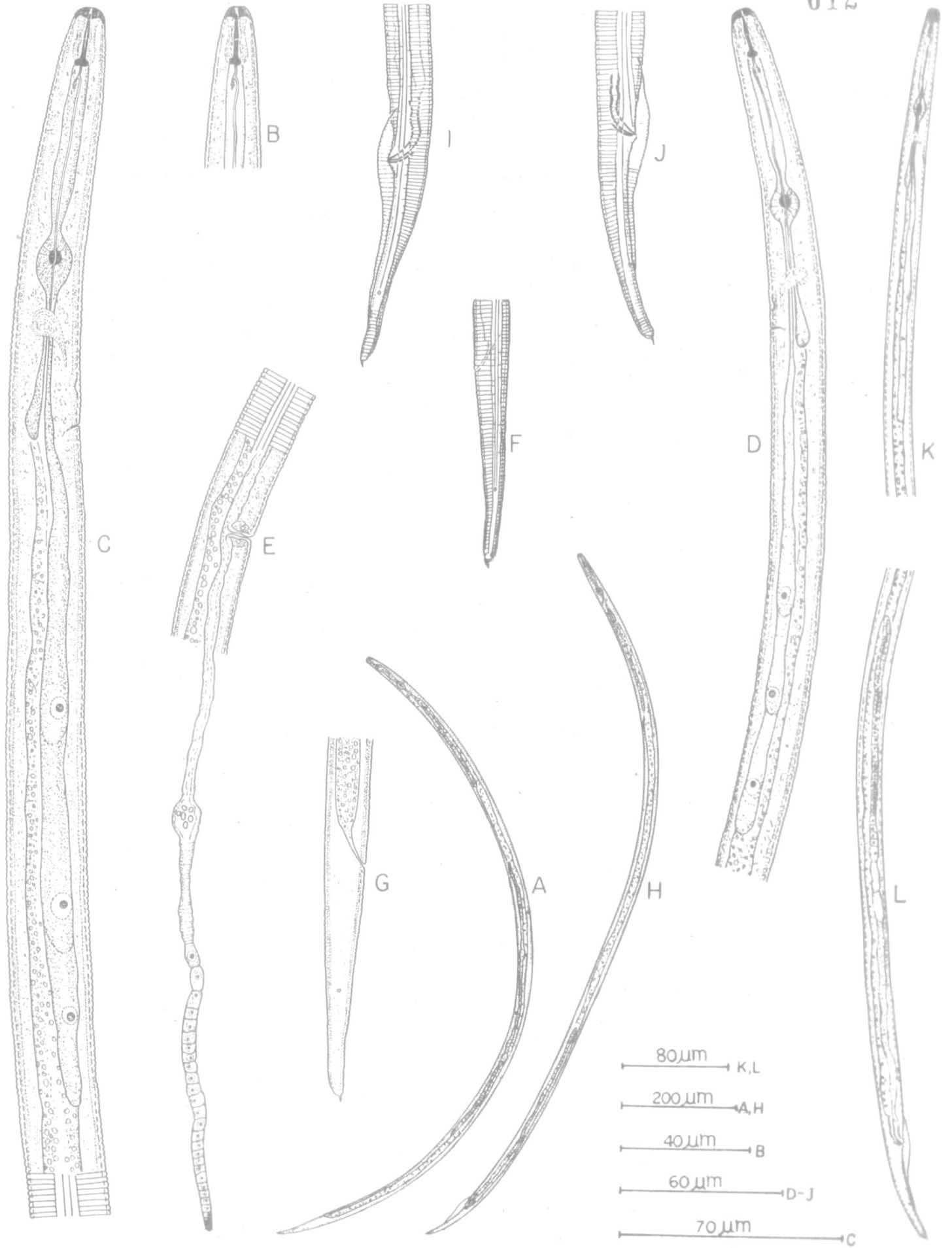
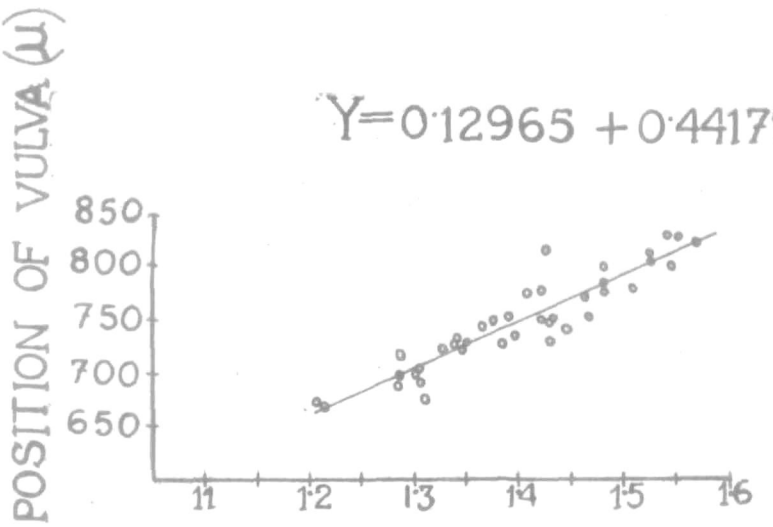
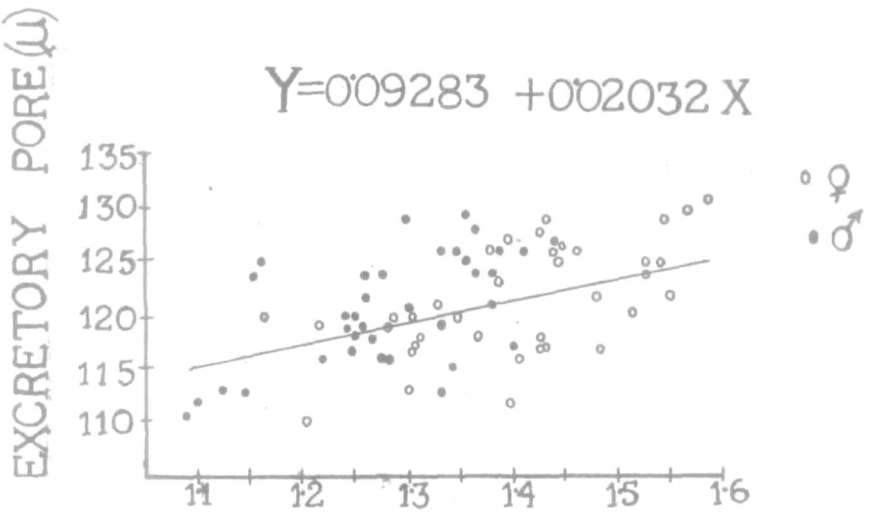
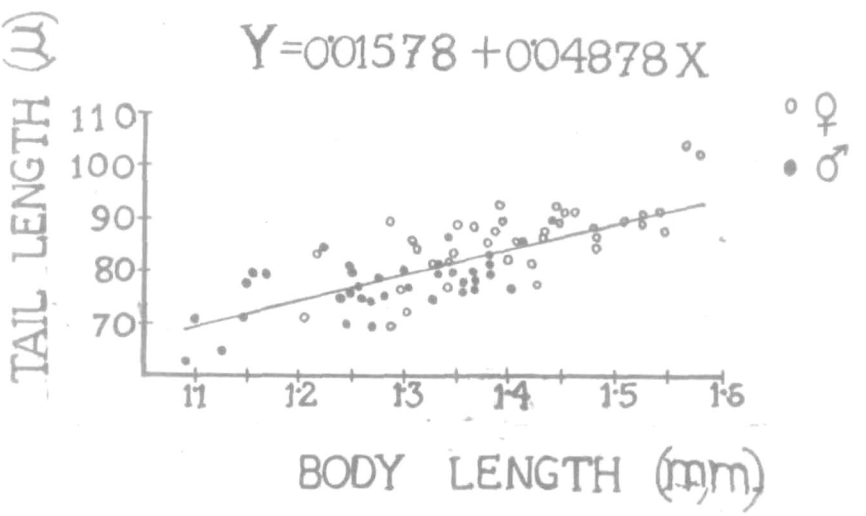
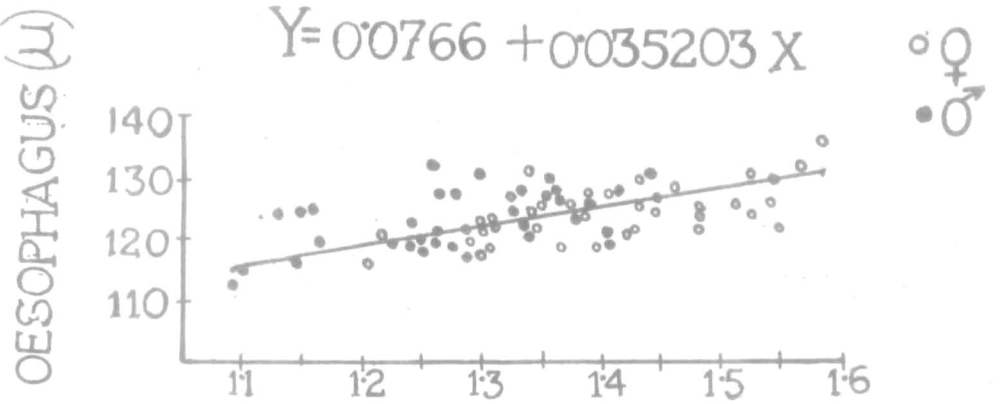


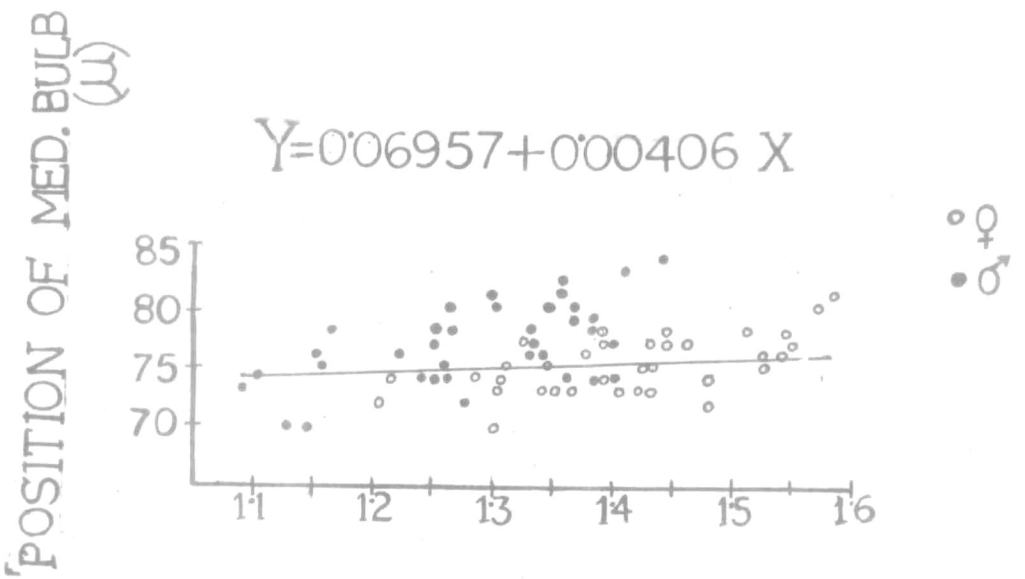
Fig. 1

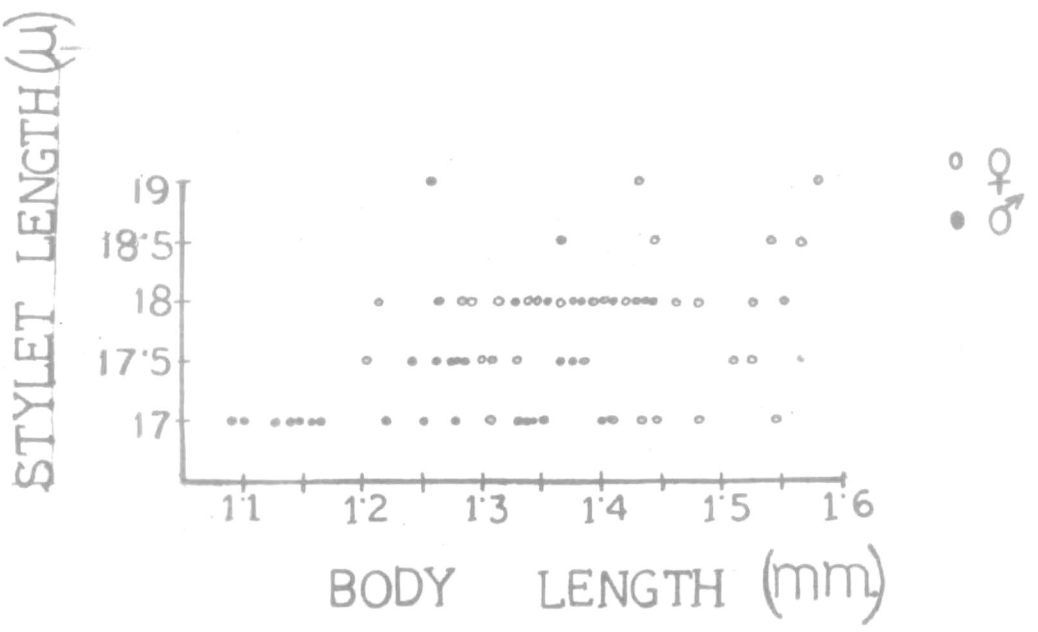

Y=0·12965 +0·44179 X
POSITION OF VULVA (μ)
850
800
750
700
650
1·1
1·2
1·3
1·4
1·5
1·6


Y=0·09283 +0·02032 X
EXCRETORY PORE (μ)
135
130
125
120
115
110
1·1
1·2
1·3
1·4
1·5
1·6
♀
♂


Y=0·01578 +0·04878 X
TAIL LENGTH (μ)
110
100
90
80
70
1·1
1·2
1·3
1·4
1·5
1·6
♀
♂
BODY LENGTH (mm)


Y= 0·0766 + 0·035203 X
OESOPHAGUS (μ)
140
130
120
110
1·1
1·2
1·3
1·4
1·5
1·6
♀
♂


Y= 0·06957 + 0·00406 X
POSITION OF MED. BULB (μ)
85
80
75
70
1·1
1·2
1·3
1·4
1·5
1·6
♀
♂


STYLET LENGTH (μ)
19
18·5
18
17·5
17
1·1
1·2
1·3
1·4
1·5
1·6
BODY LENGTH (mm)
♀
♂

STUDIES ON THE NEMATODES FROM MANGROVE SWAMPS OF DELTAIC SUNDARBANS, WEST BENGAL, INDIA. (III) ANOPLOSTOMA MACROSPICULUM N. SP. (ANOPLOSTOMATIDAE : NEMATODA)

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ANOPLOSTOMA MACROSPICULUM n. sp. is described and figured as new from a mangrove environment of deltaic Sundarbans, West Bengal. The new species under consideration is unique among all the described species of the genus Anoplostoma Butschli, 1874, in having very long and unequal spicular apparatus (5.5-7.8 a.b.d. and 12.5-16.8 a.b.d.). The worm was found to be prevalent in detritus-rich mangrove litter soil around roots of Phoenix paludosa in the intertidal zone of Hooghly estuary.

Morphology:

Anoplostoma macrospiculum n. sp. (figure I)

Pronounced sexual dimorphism. Observation based on 10 specimens (♂ 5; ♀ 5). Cuticle smooth without lateral alae. Sclerotized stoma 11-11.5 µm deep. Cephalic setae 12 of 8-9 µm long. Oesophagus 210-215 µm long, amphids obscure. Head not offset but marked with slight depression. Vulva almost pre-equatorial, gonads amphidelphic reflexed, spermatheca filled with sperms. Rectum less than one anal body-width long. Tail long, 180-185 µm or about 10.5-10.8 anal body diameters long with slightly rounded terminus possessing three 5-6 µm long caudal spines in female. Two spicula in male are of different lengths, measuring about 100-130 µm and 250-305 µm long or 5.5-7.8 a.b.d.

and 12.5-16.8 a.b.d. long with distal cephalated end. Gubernaculum somewhat spiral, 50-58 µm long. Caudal alae 82-88 um long with a posterior pair of 5 µm long spine like setae. As regards the length of the tail it is 140-150 µm or 7.3-7.9 a.b.d. long.

Since the organism does not completely agree with the described species of the genus Anoplostoma Bütschli, 1874, by its unique possession of very long and unequal spicular apparatus (5.5-7.8 a.b.d. and 12.5-16.8 a.b.d. long), it is considered as a new species and named as Anoplostoma macrospiculum sp. nov.

Type habitat and locality:

The type material has been collected from the mid-littoral zone of Gangasagar around roots of Phoenix paludosa. Habitat exposed, salinity 34‰. It has been deposited in the National Zoological Collections of Zoological Survey of India, Calcutta.

One of the authors (BS) is thankful to Zoological Survey of India for financial assistance. She is also grateful to the authorities of the Susama Devichoudhurani Marine Biological Research Institute, Sagar Island for field laboratory facilities.

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Figure 1. A. Anterior end; B. Vulva region with anterior uterine branch; C. Posterior end of female; C'. Tail tip of female; D. Spicular apparatus of male; D'. Tail tip of male.


A
B
C
C´
D´
D
50 µm

NEMATODES FROM WEST BENGAL (INDIA)
XXIII. QUALITATIVE AND QUANTITATIVE STUDIES OF PLANT AND SOIL INHABITING NEMATODES ASSOCIATED WITH PADDY CROP IN DISTRICT DARJEELING

BY

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ABSTRACT

The present paper reports 36 species of the Orders Tylenchida, Aphelenchida, Dorylaimida and Mononchida from Darjeeling district, West Bengal (India). The paper also concludes that Meloidogyne graminicola Golden & Birchfield, 1965; Hirschmanniella spp. (mainly H. gracilis and Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959 are the important pest of paddy crop in Darjeeling district.

INTRODUCTION

During October 1983, a random survey was conducted in seven localities of Darjeeling district (W. Bengal) to make the qualitative and quantitative studies of plant and soil inhabiting nematodes associated with paddy crop. Twenty soil samples were collected. In all, 36 species belonging to the Orders Tylenchida, Aphelenchida, Dorylaimida and Mononchida have been identified. The quantitative study reveals that Meloidogyne graminicola Golden & Birchfield, 1965 and Hirschmanniella spp. are the key pest of paddy in this district. Other important nematodes are Helicotylenchus spp. and Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959.

MATERIAL AND METHODS

The sampling was made at random. For the quantitative estimation, the methodology described by Baqri et. al.(1983) was

followed. The nematode population per 200 ml soil was counted from each sample. The paddy roots of each sample were processed through a blender and the nematode population per 10 gm roots was also estimated.

A. QUALITATIVE STUDY:

In all, 17 stylet bearing nematode species belonging to 12 genera of the Orders Tylenchida and Aphelenchida have been identified. Besides, 21 species of ectoparasite, soil inhabiting or predaceous nematodes have also been identified under the Orders Dorylaimida and Mononchida. The identified species are being listed below:

ORDER TYLENCHIDA THORNE, 1949

1. Tylenchus sp.
2. Filenchus sp.
3. Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959
4. Hoplolaimus indicus Sher, 1963
5. Helicotylenchus dihystera (Cobb, 1893) Sher, 1961
6. H. digitatus Siddiqi & Husain, 1964
7. H. pseudorobustus (Steiner, 1914) Golden, 1956
8. Pratylenchus scribneri Steiner, 1943
9. Hirschmanniella oryzae (Van Breda de Haan, 1902) Luc & Goodey, 1963
10. H. gracilis (de Man 1880) Luc & Goodey, 1963
11. Meloidogyne graminicola Golden & Birchfield, 1965
12. Criconemoides ornatum Raski, 1958

13. Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957

ORDER APHELENCHIDA SIDDIQI, 1980

1. Anhelenchus avenae Bastian, 1865
2. Anhelenchoides pusillus (Thorne, 1929) Filipjev, 1934

ORDER DORYLAIMIDA DE MAN, 1876

1. Laimydorus finalis Thorne, 1975
2. L. baldus Baqri & Jana, 1982
3. Laimydorus n. sp.
4. Eudorylaimus spp.
5. Labronemella anirassvi (Baqri & Khera, 1976) Andrassy, 1985
6. Onisthodorylaimus cavalcantii (Lordello, 1955) Corbonell & Coomans, 1986
7. Thornenema n. sp. I
8. Thornenema n. sp. II
9. Anorcelaimellus heynsi Baqri & Jairajpuri, 1968
10. Balondira nenalensis Siddiqi, 1964
11. Paraxydirus gigas (Jairajpuri, 1964) Jairajpuri & Ahmad, 1979
12. Tylencholaimus pakistanensis Timm, 1964
13. T. paradaxus Loof & Jairajpuri, 1968
14. Discomyctus cephalatus Thorne, 1939
15. Prolantonchus clarus Timm, 1964
16. Mecactinolaimus elaboratus (Cobb, 1906) Heyns & Agro, 1969
17. Mecactinolaimus n. sp.
18. Xiphinema insigne Loos, 1949

ORDER MONONCHIDA JAIRAJPURI, 1969

1. Mylonchulus brachyuris (Butschili, 1873) Altherr, 1954
2. Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982
3. Miononchus delhousiensis Jairajpuri, 1969.

B. QUANTITATIVE STUDY

The details of quantitative estimation of different parasitic nematode genera and other nematodes from each locality have been furnished in Table I. The number of soil samples collected from each locality has also been provided in the same Table. Table II provides the information regarding the average percent of frequency of occurrence and dominance of potential nematodes pests in soil as well as paddy roots at Darjeeling district.

The results reveal that Meloidogyne (M. graminicola) is the most important pest of rice in the area surveyed because it is present in 100% samples while it dominates in 63% soil samples. This may further be noted that Hirschmanniella spp. (mainly H. gracilis) and Tylenchorhynchus washbeedi are the other potential nematode pests because the frequency of their occurrence has been noted in 70% and 90% soil samples respectively. The former species dominated in 26% samples while the later in 10.5% samples.

The high degree occurrence and dominance of Meloidogyne and Hirschmanniella species in 10 gm roots (Table II) further

confirms that these are the key pest of paddy in the area surveyed.

The Pratylenchus, Helicotylenchus, Criconemoides, and Hemicriconemoides species were also encountered during estimation but their presence was not significant.

ACKNOWLEDGEMENT

We thank the Director, Zoological Survey of India, Calcutta, for providing research facilities. Thanks are also due to Indian Council of Agricultural Research for providing the funds under All India Coordinated Research Project on Nematode pests of crops and their control.

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BAQRI, Q.H. AND DAS, P. K. (198 . Nematodes from West Bengal. XIX. Qualitative and quantitative studies of plant and soil inhabiting nematodes associated with paddy crop in West Dinajpur district. Bull. Zool. Surv. India In press).

TABLE I

Results of the survey of Paidy crop in DARJEELING district, West Bengal
Range of nematode number with its average per 200 ml of soil.
Figures in parenthesis indicate percent frequency of occurrence.

	LOCALITY / VILLAGE			
	Doodhiya Basti	Poorbum	Tashiding	Tashiding(Upper)
No. of samples collected	4	2	2	1
Nematode				
1. Haloidogyne (larvae)	50-400: 220 (100)	150-610: 380 (100)	30-120: 75 (100)	120 : 120 (100)
2. Tylenchorhynchus	10-160: 67.5 (100)	50: 50 (50)	120-370: 245 (100)	100+100 (100)
3. Helicotylenchus	240 : 240 (25)	-	320 : 320 (50)	-
4. Pratylenchus	-	-	-	-
5. Hirschmanniella	60: 60 (25)	10: 10 (50)	50: 50 (50)	20: 20 (100)
6. Hemicriconemoides	20 : 20 (25)	-	-	-
7. Criconemoides	-	-	20: 20 (50)	-
8. Other tylenchs	10 : 10 (25)	-	-	-
9. Other dorylaims	150-600: 295 (100)	190-690: 440 (100)	200-420: 260 (100)	110: 110 (100)
10. Saprophagous	70-320 : 180 (100)	270-430: 350 (100)	160-390: 275 (100)	450: 450 (100)

TABLE I ..... contd. .....

Results of the survey of Paddy crop in DARJEELING district, West Bengal

	LOCALITY / VILLAGE		
	Tashding (Lower)	Sukna	Salbari
No. of samples collected	2	5	4
Nematodes			
1. Meloidogyne (larvae)	150 : 150 (100)	40-340:152 (100)	160-290:210 (100)
2. Tylenchorhynchus	30-60:45 (100)	40-250:152 (100)	10-300:123 (100)
3. Helicotylenchus	-	80 : 80 (20)	30 : 30 (25)
4. Pratylenchus	30 : 30 (50)	-	-
5. Hirschmanniella	20 : 20 (50)	250-390:280 (100)	50-200:113 (100)
6. Hemicriconemoides	-	-	-
7. Criconemoides	-	-	-
8. Other tylenchs	10 : 10 (50)	-	-
9. Other dorylaims	240-280:260 (100)	270-670:432 (100)	120-460:297 (100)
10. Saprophagous	390-490:440 (100)	140-300:190 (100)	60-300:143 (100)

TABLE II

The results of the survey of paddy crop in Darjeeling district, West Bengal.

Range of nematode number (potential pests) with its average for per 200 ml soil and 10 gm roots.

Figures in parenthesis indicate percent frequency of occurrence with dominance in soil/occurrence in roots.

		Soil population	Root population
1.	Meloidogyne	30-610:139 (100:63)	2-980:209 (50)
2.	Tylenchorhynchus	10-370:125 (90:10.2)	2-12:9.5 (20)
3.	Hirschmanniella	10-390:146 (70:26)	6-106:23 (60)

NEMATODES FROM WEST BENGAL (INDIA)
XXIV. QUALITATIVE AND QUANTITATIVE STUDIES OF PLANT AND SOIL INHABITING NEMATODES ASSOCIATED WITH PADDY CROP IN COOCHBEHAR DISTRICT

BY

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ABSTRACT

The present paper reports 32 species of the Orders Tylenchida, Aphelenchida and Dorylaimida from Coochbehar district (W. Bengal). The results of the quantitative estimation of different parasitic genera reveal that Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963, Tylenchorhynchus spp., Meloidogyne graminicola Golden & Birchfield, 1965 and Helicotylenchus spp. are the important nematode pests associated with paddy crop in the area surveyed.

INTRODUCTION

Baqri et al. (1983) published the first paper on the qualitative and quantitative estimations of nematodes associated with paddy crop from Burdwan district of West Bengal. This is the 24th paper of the series on Nematodes from West Bengal and 4th on qualitative and quantitative studies. During November 1984, forty root and soil samples were collected from 13 localities of the following three blocks of district Coochbehar: Toofangaunj, Pundibari and Dinhata. In all, 32 species have been identified. It is evident from the quantitative estimation of important nematode genera that Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1963; Meloidogyne graminicola Golden & Birchfield, 1965; Tylenchorhynchus spp., and Helicotylenchus spp. are the most important and abundant nematodes in the area surveyed.

MATERIAL AND METHODS

The sampling was made at random. The processing of samples and the quantitative estimation was made as described by Saqri *et al.* (1983). The nematode population per 200 ml soil was counted from each sample. The nematode population of paddy roots/10 gm was also estimated.

A. QUALITATIVE STUDY:

In all, 15 species belonging to the Orders Tylenchida and Aphelenchida (stylet bearing nematodes) have been identified. Apart from this, 17 soil inhabiting or predaceous species of the order Dorylaimida have also been identified. The identified species are listed below

ORDER TYLENCHIDA THORNE, 1949

1. *Filenchus* sp.
2. *Malenchus* sp.
3. *Basiria humida* (Colbran, 1960) Geraert, 1968
4. *Tylenchorhynchus nudus* Allen, 1955
5. *T. mashhoodi* Siddiqi & Basir, 1959
6. *Hemicriconemus indicus* Sher, 1963
7. *Helicotylenchus arenacauda* Sher, 1966
8. *H. dihystera* (Cobb, 1893) Sher, 1961
9. *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963
10. *Meloidogyne graminicola* Golden & Birchfield, 1965
11. *Ditylenchus* sp.
12. *Nothotylenchus* sp.

13. Macromosthonia ornata (Raski, 1958) De Grisse, 1965

14. Gracilacus n. sp.

ORDER APHELENCHIDA SIDDIQI, 1980

1. Aphelenchus avenae Bastian, 1865

ORDER DORYLAIMIDA DE MAN, 1876

1. Laimydorus siddiqii Baqri & Jana, 1982

2. L. baldus Baqri & Jana, 1982

3. L. finalis Thorne, 1975

4. Laimydorus n. sp.

5. Calodorylaimus simplex Baqri & Jana, 1982

6. Eudorylaimus spp.

7. Thornenema mauritianum (Williams, 1959) Baqri & Jairajpuri, 1967

8. Discolaimoides bulbiferus (Cobb, 1906) Heyns, 1963

9. Anorcelaimellus heynsi Baqri & Jairajpuri, 1968

10. Dorylaimellus indicus Siddiqi, 1963

11. D. deviatus Baqri & Jairajpuri, 1968

12. Tylencholaimus obscurus Jairajpuri, 1965

13. Discomycetus cephalatus Thorne, 1939

14. Prolentonchus clarus Timm, 1964

15. Dorylaimoides pakistanensis Siddiqi, 1964

16. D. constrictus Baqri & Jairajpuri, 1968

17. Neoactinolaimus sp.

B. QUANTITATIVE STUDY:

The results of the quantitative estimation of important parasitic genera and other nematodes from the surveyed localities

of Coochbehar district have been furnished in Table I & II. Table I provides the informations about the surveyed localities, number of samples collected, range with average and percent of frequency of occurrence of important nematode genera separately and other nematodes. Table II gives the analysis of range with average and percent of frequency of occurrence and dominance of potential nematodes in soil and paddy roots at Coochbehar district.

It is evident from Table I that the species of the genera Hirschmanniella, Helicotylenchus, Tylenchorhynchus and Meloidogyne are widely distributed species in the area surveyed. Amongst these species, Hirschmanniella gracilis appears to be a key pest of paddy in Coochbehar because of its high degree of dominance in (70%) soil samples. Table II also concludes that Hirschmanniella gracilis occurs in 95% and 48% in soil and root samples respectively. The second important nematodes are the Helicotylenchus spp. and Meloidogyne graminicola because these have been respectively recorded in 75% and 95% soil samples. Though the frequency of occurrence of Meloidogyne is higher but their dominance has been observed only in 5% soil samples. It may further be noted that Helicotylenchus spp. dominated in 20% soil samples. The number of Helicotylenchus and Meloidogyne species recovered from roots was also significant and their occurrence was noted in 20% and 12% root samples respectively. The other important nematodes are Tylenchorhynchus spp. Their occurrence in soil and roots was noted in 52% and 30% samples respectively, while they were dominant only in 5% soil samples. The presence of other parasitic nematodes was not significant.

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The authors are thankful to the Director of Zoological Survey of India, Calcutta, for providing research facilities. We also thank to Indian Council of Agricultural Research for providing funds under All India Coordinated Research Project on Nematode Pests of Crops and their Control.

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TABLE I

Results of the survey of paddy crop in Coochbehar district, West Bengal

Range of nematode number with its average per 200 ml of soil.

Figures in parentheses indicate percent frequency of occurrence.

	LOCALITY / VILLAGE				
	Gurisbar	Nayarhat	Chamta Basakpara	Ghogalkuti Mutanbazar	Ghogalkuti
No.of samples collected	1	3	3	2	2
Nematodes					
1. Tylenchorhynchus	20:20 (100)	10-30:15 (66.67)	40:40 (33.33)	200:200 (50)	10:10 (50)
2. Helicotylenchus	40:40 (100)	60-380:320 (66.67)	40-180:93.3 (100)	50-120:85 (100)	20-200:110 (100)
3. Hirschmanniella	120:120 (100)	20-100:60 (66.67)	20-340:143 (100)	50:50 (50)	100-260:180 (100)
4. Meloidogyne	20:20 (100)	30-410:175 (100)	40-220:130 (100)	110-180:145 (100)	300-350:325 (100)
5. Other tylenchs	-	20:20 (33.33)	-	-	-
6. Other dorylaims	280:280 (100)	160-520:303 (100)	230-1060:547 (100)	450-1240:845 (100)	300-340:320 (100)
7. Saprophagous	40:40 (100)	130-380	50-500:243.33 (100)	180-200:185 (100)	100-630:365 (100)

..... contd. .....

TABLE I .... contd. .....

Results of the survey of paidy crop in Coochbehar district, West Bengal

	LOCALITY / VILLAGE				
	Chilakhana	Sonari	Baraibari	Singijani Bhatamuri	Baladang
No.of samples collected	3	5	2	5	3
Nematodes					
1. Tylenchorhynchus	20-120:70 (66.67)	30-280:128 (80)	20-340:130 (100)	20:20 (20)	190:190 (33.33)
2. Helicotylenchus	20-260:137 (100)	30-220:103 (60)	20-80:50 (100)	40-200:123 (60)	80-220:167 (100)
3. Hirschmanniella	40-160:103 (100)	100-79:446 (100)	260-340:300 (100)	170-1060:428 (100)	140-220:173 (100)
4. Meloidogyne	120-160:140 (66)	10-440: 250 (80)	30-60:45 (100)	20-380:210 (100)	60-220:130 (100)
5. Macroposthonia	20:20 (33.33)	-	-	-	-
6. Other tylenchs	20-90:50 (100)	-	-	-	-
7. Other dorylaims	280-370:337 (100)	120-660:469 (100)	790-800:795 (100)	60-500:344 (100)	300-880:577 (100)
8. Saprophagous	40-230:123 (100)	40-350:214 (100)	20-80:50 (100)	80-320:184 (100)	160-680:333 (100)

..... contd. .....

Table I ..... contd. .....

Results of the survey of paidy crop in Coochbehar district, West Bengal

	LOCALITY / VILLAGE		
	Kheikhedia	Chhararkuti	Kharijakakribari
No.of samples collected	4	2	5
Nematodes			
1. Tylenchorhynchus	20-230: 125 (50)	-	30-100: 73 (60)
2. Helicotylenchus	20: 20 (25)	20: 20 (50)	70-260: 178 (80)
3. Hirschmanniella	280-1090: 588 (100)	140: 140 (100)	100-900: 462 (100)
4. Meloidogyne	30-390: 125 (100)	20-140: 80 (100)	10-120: 45 (100)
5. Other dorylaims	40-390: 245 (100)	130-240: 185 (100)	240-1100: 498 (100)
6. Saprophagous	190-430: 315 (100)	40-140: 90 (100)	160-750: 366 (100)

TABLE II

Results of the survey of paidy crop in Coochbehar district West Bengal.

Range of nematode number (potential parasites) with average per 200 ml and 10 gm roots.

Figures in parentheses indicate percent frequency of occurrence with dominance in soil occurrence in roots.

	Soil population	Root population
Potential nematodes		
1. Hirschmanniella	20-1000:311 (95:70)	20-860:160 (48)
2. Helicotylenchus	20-580:127 (75:20)	20-620:138 (30)
3. Meloidogyne	10-440:151 (90:5)	50-340:180 (12)
4. Tylenchorhynchus	10-280:90 (52.5:5)	20-200:77 (30)

NEMATODES ASSOCIATED WITH CITRUS FROM SIKKIM, INDIA

BY

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INTRODUCTION

Sikkim became the twentysecond state of Indian Union in 1975. This is a small hill state nestling in the Himalayas, situated in the North-Eastern Region of India. Sikkim has been divided into four districts, viz., North, South, East and West. Though the cultivated land is limited to 95,832 hectares, seasonal fruits like mandarin orange, guava, lime, lemon, apple, pear, plum etc. are extensively grown. Sikkim is one of the major orange producing states of India. The average annual production has been estimated to be 17,190 tonnes from 2,300 hectare of orchards. All mandarin oranges are *Citrus reticulata*. The important orange producing areas are within the elevation range of 600-1500 m above MSL.

In view of the importance of mandarin orange in the economy of the State, a random survey was conducted during

May, 1981 in East, West and South districts of Sikkim for the nematodes associated with citrus trees, Citrus reticulata. Over one hundred soil samples were collected from 12 localities of East districts, 8 localities of West district and 9 localities of South district. The analyses of these samples showed a wide variety of tylenchs ,aphelench, dorylaims, monochs and other soil inhabiting nematodes.

The present paper deals with the nematode species belonging to the orders: Tylenchida, Aphelenchida, Dorylaimida and Monochida. In all, 61 species have been identified, of which 10 are new to science. Short descriptions of already known species have also been provided. Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958, because of the high degree of dominance and abundance in the area surveyed, is suspected to be a key pest of citrus. Its allometric and morphometric variations have been discussed in detail so as to facilitate the correct identification by the nematologists involved in pathological studies.

MATERIAL AND METHODS

All the soil samples were collected from around roots of citrus, Citrus reticulata. The nematodes were fixed in hot 4% formalin and mounted in anhydrous glycerine. All the

specimens including types have been registered and deposited in the National Collection of Zoological Survey of India, Calcutta, India.

ORDER TYLENCHIDA THORNE, 1949

SUBORDER TYLENCHINA CHITWOOD IN CHITWOOD & CHITWOOD, 1950

SUPERFAMILY TYLENCHOIDEA ÖRLEY, 1880 (CHITWOOD & CHITWOOD, 1937)

FAMILY TYLENCHIDAE ÖRLEY, 1880

GENUS FILENCHUS ANDRÁSSY, 1954 (MEYL, 1961)

Filenchus sp.

(Fig. 1)

Measurements:

Females (7) : L = 0.54-0.65 mm (0.60); a = 27-30 (29);
b = 5.1-6.4 (5.8); c = 4.4-5.2 (4.8);
V = 61-65 (63.1); G_1 = 24-34 (26.6).

Male (1) : L = 0.54 mm; a = 26; b = 5.2; c = 3.7; T = 32.

Description:

Female: Body almost straight upon fixation, tapering regularly anterior to base of oesophagus and posterior to vulva. Cuticle striated finely, averaging 1.0-1.5µm apart on midbody. Lateral fields marked by 4 incisures, the inner two are not prominent. Deirids and phasmids not recognizable.

Lip region truncated, smooth, continuous with body, 5.5-6.0 µm wide and 3.5 µm high. Labial framework faintly sclerotized. Stylet 9-10 µm, divided nearly into two equal parts, with rounded basal knobs. Orifice of the dorsal oesophageal gland close to stylet base. Median oesophageal bulb oval, 9-10 x 6-7 µm, with distinct valves, and situated at 41-49% of the neck length from anterior end. Basal oesophageal bulb pyriform. Excretory pore situated in the posterior third region of isthmus. Hemizonid at the level of excretory pore or adjacent to it anteriorly.

Reproductive system typical, vagina thin walled, at right angle to the body axis. Spermatheca rounded, in some specimens filled with rounded sperms. Ovary consists of a single row of oocytes. Posterior uterine sac extending 8-10 µm beyond vulva, less than half of the corresponding body-width.

Tail 105-147 µm or 9-12.5 anal body-widths long, with a fine needle-like terminus.

Male: Similar to female in general shape and morphology. Spicules ventrally curved, 21 µm medially. Gubernaculum 5 µm. Bursa weakly developed, with crenate margins.

Habitat and locality: From soil around roots of citrus at Tadung, 9 km before Gangtok on Siliguri-Gangtok Highway, East Sikkim.

Remarks: The present material could not be identified up to species level because more specimens, specially males, are required for the correct identification.

GENUS POLENCHUS ANDRÁSSY, 1980

Polenchus shamimi sp. n.

(Fig. 2)

Measurements:

Holotype female : L = 0.54 mm; a = 42; b = 5.0; c = 4.2; V = 63; G_1 = 25.

Paratype female: L = 0.51 mm; a = 40; b = 4.8; c = 4.3; V = 62; G_1 = 28.

Paratype male : L = 0.47 mm; a = 47; b = 4.6; c = 3.7; T = 27.

Description:

Female: Body small and slender, tapering uniformly anterior to base of oesophagus and posterior to vulva. Cuticle smooth in its whole length, about 0.5 µm thick in mid-body. Subcuticle also appears smooth. Lateral fields marked by two incisures, about 1/3rd of body-width near mid-body. Deirids and phasmids not recognizable.

Lip region continuous with body, smooth, 4 µm wide and

2.0 µm high. Labial framework faintly sclerotized. Stylet 9 µm long, divided nearly in two equal parts; with comparatively large basal knobs, 2 µm wide, more or less triangular. Median bulb oval with a distinct valve, 6-7x4 µm, 48% from anterior extremity. Dorsal oesophageal gland opening near to stylet base. Terminal bulb pyriform. Cardia small. Excretory pore below the nerve ring, duct slightly sclerotized. Hemizonid adjacent to excretory pore anteriorly.

Female reproductive system typical. Vulva without a lateral flap. Vagina thin walled, situated at the right angle of the body axis. Spermatheca well off set, filled with sperms. Post uterine sac extending 6 µm beyond the vulva or about 2/3rd of the corresponding body-width. Ovary with a single row of oocytes. Tail filiform, 120-127 µm or about 17-18 times the anal body-width, with a rounded terminus.

Male: Similar to female in general shape and morphology. Testis outstretched. Spicules curved, 11 µm long medially. Gubernaculum 3 µm long. Bursa short, with smooth margin.

Type habitat and locality: From soil around roots of citrus, at Tadung, 9 km before Gangtok on Siliguri-Gangtok Highway, East Sikkim.

Differential diagnosis: Polenchus shamimi sp. n. comes close to Polenchus politus Andrássy, 1980 but differs from it in having smaller body, thinner cuticle, smooth subcuticle, differently shaped lip region, anteriorly situated excretory pore, smaller odontostyle, and tail with rounded tip (L = 0.60-0.63 mm, cuticle 1.0-1.2 µm thick, subcuticle very finely striated at both body ends, excretory pore in the middle of the terminal oesophageal bulb, stylet 14-15 µm long, and tail 193-200 µm long with fine needle like terminus in P. politus). The new species can further be differentiated in having smaller spicules in male (spicules 19 µm long in P. politus).

Remarks: Andrássy (1980) has reported inconspicuous lateral fields in P. politus. However, the lateral fields are well demarcated and marked by two incisures in P. shamimi sp. n.

The new species has been named after my teacher, Professor M. Shamim Jairajpuri, who not only trained me in nematology but also guided me in other aspects of life.

FAMILY TYLENCHORHYNCHIDAE ELIAVA, 1964 (GOLDEN, 1971)

GENUS TYLENCHORHYNCHUS COBB, 1913

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959

(Fig. 3, A-B)

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959, Proc. 46th Meet. Indian Sci. Congr. Part IV (Abs.), 35.

Tylenchorhynchus crassicaudatus Williams, 1960, Occ. Pap. Maurit. Sug. Ind. Res. Inst., 4: 1-30.

Tylenchorhynchus elegans Siddiqi, 1961, Z. Parasitenk., 21: 46-64.

Tylenchorhynchus dactylurus Das, 1960, Z. Parasitenk., 19: 553-605.

Tylenchorhynchus digitatus Das, 1960, Z. Parasitenk., 19: 553-605.

Tylenchorhynchus zea Sethi & Swarup, 1968, Nematologica, 14: 77-88.

Tylenchorhynchus mashhoodi of Baqri & Jairajpuri, 1970, Rev. Brasil Biol., 30: 61-68.

Measurements:

Females (8) : L = 0.61-0.80 mm (0.65); a = 26-45 (31);
b = 4.3-5.6 (5.1); c = 13.7-15.8 (14);
V = 55-59 (56); G_1 = 20-23; G_2 = 18-20.

Description:

Female: Body slightly ventrally curved in posterior half of the length. Cuticle marked by distinct transverse striae, 1.5-2.0 µm apart. Lateral fields marked by 4 incisures, about 1/5th-1/4th of body-width near middle. Lip region continuous, marked by 3-4 annules. Stylet 16-18 µm long, metenchium about 50-52% of the stylet length. Oesophagus typical. Median oesophageal bulb 44-46% of the oesophageal length from anterior end. Excretory pore 100-110 µm from anterior end. Reproductive system amphidelphic, outstretched. Spermatheca functional. Tail cylindrical, with bluntly rounded smooth

terminus, marked with 19-27 annules ventrally, 40-51 µm or about 2.6-4.2 anal body-widths long. Phasmids at 35-37% of tail from anus.

Male: Not found.

Habitat and localities: From soil around roots of citrus at Yangthang, near Gyalshing, West Sikkim, and Tarku, South Sikkim.

Remarks: Baqri & Jairajpuri (1970) have reported intraspecific variations of I. mashhoodi. The material under study falls in the same range.

GENUS QUINISULCIUS SIDDIQI, 1971

Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971

(Fig. 3, C-E)

Tylenchorhynchus capitatus Allen, 1955, Univ. Calif. Publ. Zool., 61: 129-166.
Tylenchorhynchus acti Hopper, 1959, Nematologica, 3: 23-30.
Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971, Indian J. Nematol., 1: 25-43.

Measurements:

Females (10): L = 0.70-0.82 mm (0.73); a = 30-38 (33.7);
b = 4.8-5.6 (5.0); c = 15.7-18.5 (16.6);
V = 55-57 (55.4); G_1 = 16-21.7 (19.6);
G_2 = 14-21.5 (19.5).

Description:

Female: Body ventrally curved, some times open 'C' shaped. Cuticle transversely striated, 1.0-1.5 µm apart. Longitudinal lines absent. Lateral fields marked by 5 incisures, about 1/5th-1/4th of body-width near middle. Lip region off set from body, bearing 6 annules, 4-5 µm high and 8 um wide. Head framework slightly sclerotized. Stylet 16-18 µm long, and its anterior end (metenchium) 8-9 µm or about 50% of stylet length. Stylet knobs indented slightly, 3.5-4.0 µm wide. Hemizonid about 2 annules long, situated at 1-4 annules above the excretory pore. Female reproductive system amphidelphic. Spermatheca non functional. Tail cylindrical, ending in a narrow rounded smooth terminus, 38-50 µm long or about 2.9-3.8 anal body-widths long, marked by 32-44 annules ventrally. Phasmids in the anterior half (28-38%) of the tail.

Male: Not found.

Habitat and localities: This is a widely distributed species in Sikkim State. Several hundred females have been collected from the following localities: Khumdong Basti, Upper Khumdong and Sang in East Sikkim; Mamring bridge, Tekgehri, Nalam, and Mangro Basti in South Sikkim; Gyalshing, Guruthang and Kabirthang in West Sikkim.

Remark : The present material corresponds with the description of the species as given by Jairajpuri (1985).

SUPERFAMILY HOPLOLAIMOIDEA FILIPJEV, 1934 (PARAMONOV, 1967)

FAMILY HOPLOLAIMIDAE FILIPJEV, 1934 (WIESER, 1953)

GENUS HOPLOLAIMUS DADAY, 1905

Hoplolaimus indicus Sher,1963

(Fig. 4)

Hoplolaimus indicus Sher, 1963, Nematologica, 9: 267-295.

Measurements:

Females (6): L = 1.18-1.37 mm (1.31); a = 28-34 (31.7);
b = 8.6-9.9 (9.0); b' = 6.0-6.9 (6.7);
c = 58-68 (55); V = 54-57 (55.8);
G_1 = 25-34 (30); G_2 = 26-32 (29.5);
O = 10.5-12 (11).

Description:

Female: Body almost straight or slightly ventrally curved upon fixation. Transverse striae about 2 µm apart. Lateral fields marked by 2-4 irregularly broken incisures at different levels of the body. Head off set, conical, marked by 3 annules. Stylet 38-45 µm long; its anterior part (metenchium) 18.5-22.5 µm or about 50% of stylet length. Oesophagus typical, overlapping

intestine dorsally. Median bulb 65-74% of the total oesophageal length from anterior end. Oesophageal glands with six distict nuclei. Orifice of the dorsal oesophageal gland 4.0-4.5 µm from base of stylet. Excretory pore 104-151 µm from anterior end or between the nerve ring and oesophago-intestinal junction. Hemizonid 8-10 annules below excretory pore. Anterior pair of cephalids 2 annules below lip region. Anterior scutellum 28-34% and posterior scutellum 79-82% of body length from anterior end. Reproductive system typical. Spermatheca functional, epiptygma single, attached anteriorly. Rectum 18-20 µm long, slightly overlapped by intestine. Tail rounded with 8-9 striae.

Male: Not found.

Habitat and localities : From soil around roots of citrus at Khumdong Basti, East Sikkim; and Mambring Bridge, South Sikkim.

GENUS SCUTELLONEMA ANDRÁSSY, 1958

Scutellonema brachyurum (Steiner, 1938) Andrásy, 1958

(Figs. 5 - 7)

Rotylenchus brachyurus Steiner, 1938; J. Agric. Research, U.S. Dept. Agric., 56 : 1-8.

Rotylenchus goheni Goodey, 1952, J. Helminth., 26: 91-96.
Rotylenchus boocki Lordello, 1957, Nematologica, 2: 273-276.
Scutellonema brachyurum (Steiner, 1938) Andrassy, 1958, Nematologica, 3: 44-56.

The random survey shows that Scutellonema brachyurum is most likely to be a key pest of citrus in East, West and South districts of Sikkim. This has been found a widely distributed, and in majority of samples the dominant species. In view of the possible economic importance and the wide distribution of this species, its allometric and morphometric variations have been studied during the present course of investigations so as to facilitate its correct identification by non-taxonomists.

Measurements: TABLE I

Description:

Female: Body curved ventrally into an open circle. Lip region slightly off set from body; broadly hemispherical, varying slightly in shape, width and height; marked by 3-4 annules, sometimes the fourth annule is incomplete. Labial framework moderately developed. Basal annule of lip region with 6 longitudinal striations (Fig. 5 M). Lateral fields 1/7-1/4.5 of the body-width near middle, marked by four incisures, sometimes areolated in oesophageal region and more

distinctly at the level of scutellum, the inner band of incisures narrower than the outer at the posterior end; the incisures terminate posteriorly by rounded or broadly rounded tips. The two incisures originate slightly above the stylet knobs, then they become three in the middle of procorpus and four at the level of nerve ring. Stylet 24.5-29 µm long. Stylet knobs flattened or slightly indented anteriorly. Metenchium 48-52% of the stylet length. Dorsal oesophageal gland opening 4.0-5.5 µm below the base of stylet. Anterior and posterior cephalids not visible. Excretory pore either anterior or posterior to the posterior end of oesophageal glands. Hemizonid 1-5 annules anterior to excretory pore, 2-3 annules long. Median oesophageal bulb 11-13 x 8-10 µm, 63-75% of the oesophageal length from anterior end. Oesophageal glands overlap intestine typically dorsally.

Vulva a transverse slit. Anterior and posterior epiptygma mostly present. Vagina extending 35-45% of the corresponding body-width. Reproductive system amphidelphic, outstretched. Spermatheca with sperms. Oocytes arranged in a single row except in the multiplication region. Rectum about one to one and a half anal body-width long. Tail mostly bluntly rounded, varying considerably at the tip, with a ventral side more pointed than dorsal; marked by 6-10 annules ventrally. Scutellum opposite to anus, slightly anterior or posterior to anus.

Male: Not found.

MORPHOMETRIC AND ALLOMETRIC VARIATIONS

The various morphometric and allometric characters of adults (females) have been furnished in Table I. The position of median oesophageal bulb, excretory pore and vulva are significantly correlated with body-length. The coefficient of correlation (R) are respectively 0.594, 0.540 and 0.888. Fig. 6 shows relationship of body length with position of median bulb and excretory pore. The length of stylet (R = 0.399), oesophagus (R = 0.435), gonads (R = 0.234 and 0.249 of anterior and posterior gonad respectively) and tail (R = 0.017) are not significantly correlated with body length. Fig. 7 shows the relationship of body length with position of vulva and stylet length.

Among all the morphometric variations and allometric characters analysed, the less variable characters were the length of stylet and its metachium, head-width and the value of V (CV $\leq$ 3). The characters which showed a high degree of variability (CV > 10) were the width of lateral fields, length of genital branches and vagina, length of tail and number of tail annules. The markedly variable characters

(CV = 7-10) were the value of O, length of oesophagus, vulva body width, anal body-width, and length of rectum. All the other characters were moderately variable (CV ranging from 4-6), i.e., median bulb, head height, excretory pore and nerve ring.

The above observations show that the length of stylet and the value of V are least variable characters. The observations are in conformity with Bird and Mai (1967) on Trichodorus christei Allen, 1957; Azmi & Jairajpuri (1978) on Helicotylenchus indicus Siddiqi, 1963; Rashid & Khan (1978) on Pratylenchus coffeae (Zimmermann, 1896); Baqri & Ahmad (1981) on Tylenchorhynchus nudus Allen, 1955; and many others.

Habitat and localities: From soil around roots of citrus at Khamdong Basti, Sang, Tadung, Majirtar, Samdur, Namli Gardens, Sajung and Brung Pandam in East Sikkim; Mamring Bridge, Kusur, Turung, Tekgehri, Nalam, Tarku, Ben, Kwezing and Mangro Basti in South Sikkim; Geyzing West, Gyalshing, Guruthang, Yangthang Tik Juk, Yangthang, Raythang and Changshah in West Sikkim.

Remarks: Van den Berg and Heyns (1973) have reported that the males of S. brachyurum are rare, one per 200 females. Unfortunately, no male specimen was found from Sikkim. Sher (1963) has remarked S. brachyurum as the most cosmopolitan species of Scutellonema.

TABLE I

Morphometric and allometric variations in *Scutellonema brachyurum*. 55 ♀♀

Characters	Range	Mean	S.D.	C.V.
Length (mm)	0.52-0.80	0.68	0.05	8.2
a	22-34	27.3	2.23	8.1
b	5.3-7.7	6.4	0.53	8.2
b'	4.6-6.8	5.2	0.39	7.8
c	49-88	72.4	9.63	13.2
c'	0.5-0.8	0.59	0.60	10.2
V	56-64	60.4	1.68	2.7
G_1	18-31	24.5	3.41	13.9
G_2	15-28	23.2	2.98	12.8
m	65-76	70.3	2.71	3.8
o	15-21	17.4	1.40	8.1
Lateral fields (µm)	4.0-5.5	4.7	0.50	10.6
Head height (µm)	4.5-5.5	5.2	0.30	5.7
Head width (µm)	8.5-10.0	9.0	0.27	3.1
Stylet (µm)	24.5-29.0	26.6	0.91	3.4
Conus/Metenchium (µm)	12.0-14.5	13.2	0.47	3.6
Oesoph. length (µm)	90-122	107	7.56	7.0
Dorsal oesophageal gland opening (µm)	4-5	4.6	0.40	8.8
Med. oesophageal bulb from anterior end (µm)	65-82	74.0	3.62	4.8
N.R. (µm)	78-100	90.0	4.73	5.2
Excretory pore (µm)	108-138	123.0	8.28	6.70
Vulva Body-width (µm)	21-31	25.1	2.28	9.0
Vagina length (µm)	8-11	10.6	3.86	36.3
Ant. G (µm)	130-227	168	27.13	16.1
Post. G (µm)	118-207	159	23.88	15.0
Rectum (µm)	8-12.5	11.0	1.05	9.4
Tail (µm)	8-12	9.5	1.10	11.6
Tail Ann.	6-10	8.2	1.11	13.4
Anal Body diameter (µm)	13-19	15.9	1.35	8.5

GENUS HELICOTYLENCHUS STEINER, 1945

Helicotylenchus dihystera (Cobb, 1893) Sher, 1961

(Fig. 8, A-C)

Tylenchus dihystera Cobb, 1893, Agric. Gaz. N. South Wales, 4: 808-833.

Tylenchus robustus de Man, 1876, Tijdschr. Nederl. Dierk. Vereen, 2: 78-196.

Tylenchus olae Cobb, 1906, Bull (5), Hawaiian Sugar Planters' Ass. Exper. Station, Div. Path. Physiol., 2: 163-195.

Tylenchus spiralis Cassidy, 1930, Hawaiian, Planters' Rec., 34: 379-387.

Helicotylenchus nannus Steiner, 1945, Proc. Helminth. Soc. Wash., 12: 34-38.

Helicotylenchus crenatus Das, 1960, Ztschr. Parasitenk., 19: 553-603.

Measurements:

Females (10): L = 0.63-0.76 mm (0.58); a = 23-32 (26);
b = 5.1-6.1 (5.4); b' =4.3-5.0 (4.5);
c = 33.5-42.0 (36); V = 58-68 (64);
G_1 = 16-24 (21); G_2=13-23 (18); O=28-40 (36).

Description:

Female: Body spirally curved. Lip region continuous, rounded, marked by 4 annules. Labial framework moderately developed. Stylet 25.0-27.5 µm long. Stylet knobs flattened or slightly indented anteriorly. Excretory pore 105-137 µm, near the oesophago-intestinal junction. Hemizonid 0-2 annules

anterior to excretory pore, 2 annules long. Spermatheca rounded, without sperms. Tail dorsally curved with a slight ventral projection. Phasmids 6-8 annules anterior to anus.

Habitat and localities: From soil around roots of citrus, at Namli Gardens, Khumdong Basti, Seng, Duga and Tadung in East Sikkim; Tarku and Ben in South Sikkim; Gyalshing, Yangthang, Raythang and Kabirtheng in West Sikkim.

Remarks: Helicotylenchus dihystera is a widely distributed and a highly variable species. In a few samples, it was dominant over other nematode species. Saqri & Ahmad (1983) have already discussed variations in different populations of H. dihystera from India.

Helicotylenchus exallus Sher, 1966

(Fig. 8, D-H)

Helicotylenchus exallus, Sher, 1966, Nematologica, 12: 1-56.

Measurements:

Females (10): L = 0.66-0.79 mm (0.73); a = 28-36.5 (30.5); b = 5.2-5.8 (5.4); b' = 4.4-5.0 (4.6); c = 36-40 (38); V = 62-64 (63.2); G_1 = 17-24 (20.3); G_2 = 16-20 (17.8); O = 35-38 (36).

Male (1): L = 0.75 mm; a = 31; b = 5.0; b' = 4.3; c = 37; T = 34; O = 41.6.

Description:

Female: Body spirally curved. Lip region rounded, marked with 4-5 annules. Labial framework moderately developed. Anterior cephalids just below the labial framework, posterior cephalids opposite the posterior third of metenchium. Stylet 26.0-28.5 µm, metenchium 12-14 µm or 46-50% of the stylet length. Stylet knobs indented anteriorly, 4-5 µm wide. Median oesophageal bulb 60-62% of the oesophageal length from anterior end, 11-12 x 8-9 µm. Excretory pore 101-125 µm from anterior end. Spermatheca functional, filled with sperms. Tail 18-21 µm long, marked by 7-10 annules ventrally, with a ventral projection having rounded terminus. Inner two incisures of the lateral fields almost U-shaped at the tail terminus. Phasmids situated 5-10 annules anterior to anus.

Male: Lip region hemispherical, slightly higher than female, marked by 5 annules. Stylet 24 µm long. Stylet knobs indented anteriorly, 3.5 µm wide. Spicules 27 µm long along the curved median line. Gubernaculum 8 µm. Bursa terminal.

Habitat and locality: From soil around roots of citrus at Tadung, about 10 km before Gangtok on Siliguri-Gangtok Highway, East Sikkim.

Helicotylenchus egyptiensis Tarjan, 1964

(Fig. 8, I-L)

Helicotylenchus egyptiensis Tarjan, 1964, Nematologica, 10: 185-191.

Measurements:

Females (10): L = 0.58-0.64 mm (0.62); a = 25-30 (28); b = 4.7-5.5 (5.0); b' = 4.2-4.7 (4.4); V = 60-63 (61); G_1 = 19-24 (21); G_2 = 17-20 (18.6); O = 32-38 (33.8).

Description:

Female: Body spirally curved. Lip region slightly flat at apex, marked with 4-5 annules. Labial framework moderately developed. Anterior cephalids not seen, posterior cephalids in the middle of stylet region. Stylet 24-25 µm long, metenchium 11.5-12.0 µm or about 48-50% of the stylet length. Stylet knobs with slightly indented surface, about 4 µm wide. Median oesophageal bulb at 60-64% of the oesophageal length from anterior end, 11-13 x 8-10 µm. Excretory pore 103-108 µm from anterior end, opposite the posterior part of the isthmus. Spermatheca without sperms. Tail 22-25 µm long, marked by 12-14 annules ventrally, with elongate ventral projection.

The inner two incisures fuse in the middle of tail. Phasmids located at the level of anus or 2 annules posterior to anus.

Habitat and localities: From soil around roots of citrus at Raythang, West Sikkim. Few females were also collected from Mangro Basti, South Sikkim.

Remarks: The present population fits well with the original description of H. egyptiensis except in the shape of lip region (slightly flat at apex against truncated in the original description).

GENUS ROTYLENCHUS FILIPJEV, 1936

Rotylenchus sp.

(Fig. 9)

Measurements:

Females (12): L = 0.68-0.84 mm (0.77); a = 30-37 (32.8);
b = 5.3-7.0 (6.0); b' = 4.3-5.3 (4.9);
c = 50-83 (66.2); V = 67-72 (70.2);
G_1 = 12.6-23.0 (18.6); G_2 = 12-16 (13.7);
O = 27-31 (26.8).

Descriptions:

Female: Body spirally curved upon fixation, tapering, gradually anterior to oesophago-intestinal junction.

Transverse striae 1.5-2 µm apart. Lateral fields marked with 4 incisures, about 1/6th-1/5th of body-width near middle.

Head continuous with body, flat at apex, marked by 4 annules. Stylet 24-26 µm; anterior part (metenchium) 11.0-12.5 µm or 46-48% of stylet length. Stylet knobs indented anteriorly, 4.0-4.5 µm wide. Anterior pair of cephalids just below the head framework. Oesophagus typical, overlapping intestine dorsally. Orifice of the dorsal oesophageal gland 6.5-7.5 µm from base of stylet. The position of excretory pore varies from the base of isthmus up to oesophago-intestinal junction, 102-127 µm from anteroir end. Hemizonid 2 annules wide, either one annule anterior to excretory pore or on the same annule. Nerve ring 90-112 um from anterior end.

Female reproductive system amphidelphic. Spermatheca non-functional. Oocytes arranged in a single row except in the growth region. Tail terminus hemispherical, slightly more curved dorsally, 9.0-16.5 µm long, marked by 5-11 annules ventrally. Phasmids 1-5 annules above the anus.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Yangthang, West Sikkim.

Remarks: The present material has been reported here as Rotylenchus sp. because it does not fit with the description of any known species of the genus. In fact, these specimens share the characters of the genera Rotylenchus and Varotylus Siddiqi, 1986. Further attempt will be made to collect more specimens.

FAMILY PRATYLENCHIDAE THORNE, 1949 (SIDDIQI, 1963)

GENUS PRATYLENCHUS FILIPJEV, 1936

Pratylenchus hexincisus Taylor and Jenkins, 1957

(Fig. 10, A-C)

Pratylenchus hexincisus Taylor & Jenkins, 1957, Nematologica, 2: 159-174.

Measurements:

Females (2): L = 0.43-0.48 mm; a = 24-27; b = 4.0-4.2; b' = 3.6-3.8; c = 16-17; V = 73-75; G_1 = 28-30.

Description:

Female: Body curved ventrally. Cuticle marked by transverse striae, 1 µm apart. Lateral fields marked by 4 incisures in mid-body. Lip region marked by two distinct annules. Stylet 15 µm long, stylet knobs somewhat rounded, 4 µm wide.

Dorsal oesophageal gland opening 2 µm posterior to stylet knobs. Basal oesophageal bulb overlaps intestine slightly more than corresponding body width. Excretory pore 62-75 µm from anterior end. Hemizonid just anterior to excretory pore. Spermatheca without sperms. Posterior uterine sac about one body-width. Tail 27-29 µm or about 2.2 anal body-widths long, subcylindrical, with rounded smooth tip.

Habitat and locality: From soil around roots of citrus at Sajung, East Sikkim.

Pratylenchus scribneri Steiner, 1943

(Fig. 10, G-I)

Pratylenchus scribneri Steiner in Sherbakoff & Stanley, 1943, Tenn. Agr. Exp. Sta. Bull., 186: 1-142.

Tylenchus penetrans Cobb, 1917, Jour. Agr. Research U.S. Dept. Agric., 11: 27-33.

Pratylenchus penetrans Filipjev & Shuurmans Stekhoven, 1941; Manual Agric. Helminth. 878 pp. Brill, Leiden.

Measurements:

Females (7): L = 0.37-0.47 mm (0.43); a = 22-29 (25.6);
b = 4.8-5.5 (5.1); b' 3.6-4.5 (4.0);
c = 14-18 (15.4); V = 69-73 (71.5);
G_1 = 28-32 (29.4).

Description:

Female: Body almost straight upon fixation. Cuticle striated, averaging 1 µm apart on mid-body. Lateral fields marked by 4 incisures. Lip region more flat, marked with two distinct annules. Labial framework typical to the genus. Stylet 15-16 µm long. Stylet knobs slightly cup - shaped about 4 µm wide. Dorsal oesophageal gland opening 2.0-2.5 µm posterior to stylet knobs. Basal oesophageal bulb overlaps intestine about 1.5-2.0 body-widths. Excretory pore 69-78 µm from anterior end. Hemizonid 0-2 annules anterior to excretory pore, 3 annules wide. Spermatheca without sperms. Posterior uterine sac about 0.6 of the corresponding body - width. Tail tapering in posterior half with smooth rounded terminus, 25-32 µm or 2.3-2.9 anal body-widths long.

Habitat and locality: From soil around roots of maize and citrus near Singtam on Siliguri-Gangtok Highway, East Sikkim.

Pratylenchus loosi Loof, 1960

(Fig. 10, D-F)

Pratylenchus loosi Loof, 1960, Tijdschr. Plantenziekten, 66: 29-90.

Measurements:

Females (4): L = 0.45-0.51 mm; a = 25-31; b = 4.9-5.4; b' = 3.5-4.2; c = 15.0-16.3; V = 72-76; G_1 = 24-27.

Description:

Females: Body ventrally curved. Cuticle marked by transverse striae, 1 µm apart. Lateral fields marked by four incisures in mid-body. Lip region marked by two distinct annules. Stylet 15.0-16.5 µm long, stylet knobs indented, 4 µm wide. Dorsal oesophageal gland opening 2 µm posterior to stylet knobs. Basal oesophageal bulb overlaps intestine about three corresponding body-widths. Excretory pore 77-82 µm from anterior end. Hemizonid just anterior to excretory pore. Spermatheca functional with sperms. Posterior uterine sac about 1.5 of the corresponding body-width. Tail 29-34 um or about 2.7-2.8 anal body widths long, subcylindrical with narrow rounded terminus.

Habitat and locality: From soil around roots of citrus at Tarku, South Sikkim.

FAMILY MELOIDOGYNIDAE SKARBILOVICH, 1959 (WOUTS, 1973)

GENUS MELOIDOGYNE GOELDI, 1892

Meloidogyne sp.

Several hundred larvae and a few males of Meloidogyne sp. were recovered from soil around roots of citrus trees from the following localities: Khumdong Basti, Tadung, and Sajung in East Sikkim; Tekgehri, Tarku and Kwezing in South Sikkim; Gyalshing and Geyzing West in West Sikkim.

In most of these orchards, paddy is grown every year. Most likely these larvae and males belong to Meloidogyne graminicola Golden & Birchfield, 1965 because this has been recorded as a key pest of paddy from the bordering district Darjeeling of West Bengal by Baqri & Basu (in press). Since the mature females could not be collected, material is hereby reported as Meloidogyne sp.

SUPERFAMILY ANGUINOIDEA NICOLL, 1935

FAMILY ANGUINIDAE NICOLL, 1935

GENUS NOTHOTYLENCHUS THORNE, 1941

Nothotylenchus hexaglyphus Khan and Siddiqi, 1968

(Fig. 11, A-B)

Nothotylenchus hexaglyphus Khan & Siddiqi, 1968, Nematologica, 14: 369-376.

Measurements:

Female (1): L = 0.69 mm; a = 30; b = 6.0; c = 12.8; V = 82.6; G_1 = 44.5.

Description:

Female: Body slightly ventrally curved in the posterior region upon fixation, tapering gradually anterior to base of oesophagus and posterior to vulva. Cuticle finely striated, averaging about 1.2 µm apart at mid-body. The lateral fields marked by six incisures.

Lip region small, slightly flattened anteriorly. Stylet poorly knobbed at base, 8 µm long or about 1.2 head-width long. Orifice of dorsal oesophageal gland about 1.5 µm from stylet knobs. Corpus cylindrical, slightly swollen at base. Isthmus enlarges to form a pyriform bulb which is distinctly off set from intestine. Nerve ring 81 µm from anterior end. Hemizonid about one body-width posterior to nerve ring. Excretory pore just behind hemizonid, the duct leads into a ventrally placed renette cell .

Vulva a transverse slit. Vagina extending about half of the corresponding body-width. Posterior uterine sac about half of the vulvar body-width. Spermatheca without sperms. Ovary outstretched. Tail conoid, 54 µm or about 4 anal body-widths long, with finely rounded terminus.

Habitat and locality: Soil around roots of citrus at Gyalshing, West Sikkim.

Remarks: The present specimen agrees with the original description of N. hexaglyphus provided by Khan & Siddiqi (1968) except for its longer and well developed renette cell.

SUBORDER CRICONEMATINA SIDDIQI, 1980

SUPERFAMILY CRICONEMATOIDEA TAYLOR, 1936 (GERAERT, 1966)

FAMILY CRICONEMATIDAE TAYLOR, 1936 (THORNE, 1949)

GENUS CRICONEMOIDES TAYLOR, 1936

Criconemoides informis (Micoletzky , 1922) Taylor, 1936

(Fig. 12, A-B)

Hoplolaimus informis Micoletzky, 1922; Arch. Naturg. Berlin (1921) Abt. A, 87 (8): 1-320b.

Criconema informe (Micoletzky, 1922) Micoletzky, 1925, K. Danske Vidensk. Selsk. Skr. Naturv. Og Math. Afd., 8, R. 10: 57-310.

Criconemoides informis (Micolitzky, 1922) Taylor, 1936; Tr. Am. Micr. Soc., 55: 391-421.

Macroposthonia informis (Micoletzky, 1922) de Grisse & Loof, 1965, Mededel. Landb. Opzoek. Staat Gent., 30: 577-603.

Criconema anura Kirjanova, 1948, Publ. ded. mem. Acad. Sergei Alexeivich Zernov, Acad. Sci. USSR, 1948, 346-358.

Criconemoides flandriensis de Grisse, 1964, Nematologica, 9 (1963): 547-552.

Criconemoides complexa Jairajpuri, 1964, Nematologica, 9(1963): 381-385.

Measurements:

Tekgehri population:

Female (1): L = 0.50 mm; a = 12.5; b = 4.4; c = 750; V = 94.

Khumdong population:

Female (1): L = 0.39 mm; a = 11; b = 4.0; c = 729; V = 92.

Description:

Female: Body slightly curved ventrally. Annules (R) 63-74, posterior margins smooth. Four submedian lobes typical to the genus. Stylet robust, 60-66 µm long or 13-15% of body length; with forwardly projecting basal knobs, 8-9 µm wide; Rst = 8-9. Oesophagus with convoluted lumen in procorpus; narrow isthmus surrounded by nerve ring and slightly pyriform basal bulb; Roes = 13-15. Vulva closed, RV = 3-5. Spermatheca non-functional. Tail short, Ran = 1-3.

Habitat and localities: From soil around roots of citrus at Tekgehri and Khumdong, South Sikkim and East Sikkim respectively.

GENUS HEMICRICONEMOIDES CHITWOOD & BIRCHFIELD, 1957

Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957

(Fig. 12, F-G)

Criconemoides cocophillus Loos, 1949, J. Zool. Soc. India, 1: 23-29.

Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957, Proc. Helminth. Soc. Wash., 24: 80-86.

Hemicycliophora cocophillus (Loos, 1949) Goodey, 1963, London: Methuen. 2nd ed. revised by J.B. Goodey, 544 pp.

Hemicriconemoides communis Edward & Misra, 1964, Nematologica, 9: 405-411.

Hemicriconemoides microdoratus Dasgupta, Raski & Van Gundy, 1969, J. Nematol., 1: 126-145.

Measurements:

Females (4): L = 0.53-0.55 mm; a = 19-21.5; b = 4.8-5.2; c = 33-43; V = 92-93.

Description:

Females: Body slightly curved ventrally. Cuticular sheath double, well separated in tail region. Annules (R) 127-136; posterior margin smooth. Head slightly marked from body; labial annules 2, first annule smaller than the second. The labial disc elevated. Stylet 57-62 µm; with forwardly projecting basal knobs, 7 µm wide; Rst = 14-16. Oesophagus typical, Roes = 25-27. Vulva open, vulvar sheath well developed; RV = 10-13. Tail convex conoid; Ran = 4-6.

Habitat and locality: From soil around roots of citrus at Tekgehri, South Sikkim.

Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957

(Fig. 12, C-E)

Criconemoides brachyurus, Loos, 1949, J. zool. Soc. India, 1: 23-29.

Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957, Proc. Helminth. Wash., 24: 80-86.

Hemicycliophora brachyurus (Loos, 1949) Goodey, 1963; London: Metheun. 2nd ed. revised by J.B. Goodey, 544 pp.

Measurements:

Females (5): L = 0.45-0.53 mm; a = 12-15; b = 4.4-5.0; c = 29-31; V = 93-94.

Description:

Female: Body slightly curved ventrally. Cuticular sheath double, well separated in the mid-body and tail region. Annules (R) 97-103, posterior margin smooth. Head continuous with body; labial annules 2, first annule smaller than the second. Stylet 54-57 µm; with forwardly projecting basal knobs, 8-9 µm wide; Rst = 11-12. Oesophagus typical; Roes = 18-21. Vulva open; vulvar sheath well developed; RV = 8-10. Tail convex-conoid ; Ran = 4-5.

Habitat and locality: From soil around roots of citrus at lower Yangthang, near Gyelshing, West Sikkim.

ORDER APHELENCHIDA SIDDIQI, 1980

SUBORDER APHELENCHINA GERAERT, 1966

SUPERFAMILY APHELENCHOIDEA FUCHS, 1937 (THORNE, 1949)

GENUS APHELENCHUS BASTIAN, 1865

Aphelenchus avenae Bastian, 1865

(Fig. 11, C-F)

Aphelenchus avenae Bastian, 1965, Tr. Linn. Soc. London, 25: 73-184.

Aphelenchus agricola de Man, 1881, Tijdschr. Nederl. Dierk. Vereen., 5: 138-143.

Isonchus radicicolus Cobb, 1913, J. Wash. Acad. Sci., 3: 432-444.

Aphelenchus (Paraphelenchus) maupasi Micoletzky, 1922, Arch. Naturg., Berlin, 87: 321-650.

Aphelenchus micoletzkyi Steiner, 1941, Proc. Biol. Soc. Wash. 54: 31-34.

Metaphelenchus rhopalocercus Steiner, 1943, Bol. San. Veg., Chile, 3: 95-116.

Aphelenchus macrobolbus Steiner, 1942, Proc. Helminth. Soc. Wash. 9: 32-38.

Aphelenchus maximus Das, 1960, Ztschr. Parasitenk., 19: 553-605.

Aphelenchus mirzai Das, 1960, Ztschr. Parasitenk., 19:553-605.

Measurements:

Females (10): L = 0.61-0.75 mm (0.65); a = 31-45.5 (38.5); b = 5.0-5.7 (5.2); b' = 3.6-4.4 (4.1); c = 22-33 (29.8); V = 76-79 (77.8); G_1 = 31-50 (40.8); G_2 = 4.4-7.6 (6.1).

Male (1) : L = 0.70 mm; a = 28; b = 6.7; b' = 4.3;
c = 27; T = 70.

Description:

Female: Body slightly ventrally curved upon fixation and tapering gradually at both ends. Cuticle striated finely, 1.5-2.0 µm thick, striae averaging 1.2 µm apart. Lateral fields 1/2.3-1/3.8 body-width near middle and marked by 10-12 incisures. Head slightly off set. Median oesophageal bulb and oesophageal glands typical to the genus. Excretory pore at the level of nerve ring or slightly posterior to it. Stylet without basal knobs, 13-15 µm long. Female reproductive system mono-prodelphic; ovary outstretched. Post uterine sac 32-35 µm or 2.0-3.0 vulvar body width long. Rectum 11-13 µm, slightly longer than one anal body-width. Tail short, cylindrical, 20-30 µm or 2.0-2.3 anal body-widths long.

Male: Body slightly ventrally curved in its posterior third and tapering gradually towards anterior end. Excretory pore slightly below the nerve ring, 105 µm from anterior end. Stylet without basal knobs, 15 µm long. Spicules 27 µm long medially. Gubernaculum 14 µm long. Bursa typical to the genus.

Habitat and localities: From soil around roots of citrus at Khumdong Basti, Sang, Majirtar Basti, Samdur, Duga and Tadung in East Sikkim; Turung, Tekgehri, Nalam, Tarku, Mangro Basti and Ben in South Sikkim; Gyalshing, Yangthang Tik juk, Raythang, Yangthang and Kabirthang in West Sikkim. A single male was collected from around roots of citrus near Gangtok, East Sikkim.

ORDER DORYLAIMIDA PEARSE, 1942

SUBORDER DORYLAIMINA PEARSE, 1936

SUPERFAMILY DORYLAIMOIDEA DE MAN, 1876

FAMILY DORYLAIMIDAE DE MAN, 1876

GENUS LAIMYDORUS SIDDIQI, 1969

Laimydorus minimus sp. n.

(Fig. 13)

Measurements:

Tarku population (type):

Holotype Female : L = 1.47 mm; a = 36; b = 3.7; c = 8.7; V = $^{11.5}_{50.4}{}^{12.0}$.

Paratype Females (2): L = 1.30-1.44 mm; a = 34-36; b = 3.4-3.6; c = 8.9-9.1; V = $^{12}_{50-52}{}^{11-12}$.

Mangro Basti population:

Females (3): L = 1.40-1.48 mm; a = 34-35; b = 3.5-3.7; c = 9.3-9.6; V = $^{11.8-12.8}_{49-52}{}^{11-12}$.

Description:

Female: Body ventrally curved upon fixation, tapering slightly towards both extremities. Cuticle finely striated, 3-8 µm thick (thickest on tail). Lateral hypodermal chords 1/7th-1/6th of body-width near middle. Dorsal and ventral body pores indistinct; only 27 lateral body pores could be counted in one female, of which 10 occur in neck region.

Lip region marked off by a slight depression, about 1/3rd of body-width at base of oesophagus. Amphids stirrup-shaped; their apertures 6-7 µm from anterior end, 9-10 µm wide or occupying 64-70% of the corresponding body-width. Sensillar pouches 16-18 µm from amphidial slits. Odontostyle 33-38 µm or 2.3-2.7 lip region-widths long; aperture 11-12 µm. Guiding ring 19.0-20.5 µm or 1.4-1.5 lip region - width from anterior end. Odontophore shorter than odontostyle, 28-35 µm or 0.8-0.9 of odontostyle length. Basal expanded part of oesophagus occupying 44-47% of the neck region. The positions of oesophageal gland nuclei and their orifices are as follows: DO = 54.1-54.7; DN = 57.0-57.4; DO-DN=2.7-2.9; S_1N_1 = 57-60;

S_1N_2 = 68-69; S_2N = 77-78; S_2O = 87-88; K = 54-61; K' = 60-66. Cardia tongue-shaped, enveloped by intestinal tissue. Nerve ring 132-147 µm or 33-37% of the neck region from anterior end. Prerectum 80-96 µm or 3.3-4.0 anal body-widths long. Rectum 30-40 µm or 1.2-1.8 anal body-widths long.

Vulva longitudinal. Vagina thick-walled, extending inward 19-22 µm or about half of the corresponding body-width. Female reproductive system amphidelphic. The sperm present in the uterus of one female, 3-5 µm long. The uterus and oviduct separated by sphincter. Ovaries reflexed; oocytes arranged first in a single row, then in double rows and multiple rows at growth region.

Tail elongate, tapering gradually with sharp acute terminus, 143-180 µm or 6.1-7.5 anal body-widths long, with two caudal pores on each side.

Male: Not found.

Type habitat and locality: From soil around roots of citrus at Tarku, South Sikkim.

Mongro Basti Population: From soil around roots of citrus at Mangro Basti, South Sikkim.

Other localities: Two females were also collected (one each) from Khumdong and Phangla, East Sikkim.

Differential diagnosis: Leimydorus minimus sp. n. is distinct from all the species of the genus in having odontostyle more than two head-widths long with shorter body length (L = more than 2 mm having 2 head widths long odontostyle in other species). However, it comes close to L. siddiqii Baqri & Jana, 1982 but differs in having smaller body and odontostyle, odontophore smaller than odontostyle, wider and differently shaped amphids, and tail tip sharper and narrower (L = 1.99-2.7 mm, odontostyle = 29-31 µm, odontophore longer than odontostyle, amphidial apertures occupying 54-60% of the corresponding body-width and tail tip rounded in L. siddiqui).

Leimydorus coomansi sp. n.

(Fig. 14)

Measurements:

Holotype Female (1): L = 3.16 mm; a = 43; b = 4.3; c = 13; V = $^{15}_{43}{}^{17}$.

Paratype Female (1): L = 3.25 mm; a = 40; b = 4.6; c = 12.8; V = $^{14}_{42}{}^{15}$.

Paratype Male (1): L = 3.31 mm; a = 37; b = 4.5; c = 110.5; T = 37.

Description:

Female: Body nearly straight upon fixation, tapering slightly towards both ends. Cuticle finely striated, 4.5-7.0 µm thick (thickest on tail). Lateral hypodermal chords about 1/4th of body-width near middle. Body pores counted in holotype female. Dorsal body pores 27 up to vulva region. Ventral body pores 58, spaced irregularly throughout the body. Lateral body pores 101, of which 34 occur in the neck region.

Lip region marked off by a slight constriction, about 1/3.5 of body-width at base of oesophagus. Amphids stirrup-shaped; their apertures 8 µm from anterior end, 10 µm wide or occupying about half of the corresponding body-width. Sensillar pouches 18 µm from amphidial slits. Odontostyle 38-40 µm or about two lip region-width long; aperture 15-16 µm. Guiding ring 24 µm or 1.2 lip region width from anterior end. Odontophore 44-45 µm or slightly more than one odontostyle length. Basal expanded part of oesophagus occupying about half of the neck region. Locations of the oesophageal gland nuclei and their orifices are as follows: DO = 51.3; DN = 52.5; DO-DN=1.2; S_1N_1 = 71; S_1N_2 = 75; S_2N = 85.5; S_2O = 86; K = 81; K' = 80. Cardia short, rounded, enveloped by intestinal tissue. Nerve ring 200-217 µm or 27-30% of neck region from anterior end. Prerectum 175-185 µm or about 6.5 anal body widths long. Rectum 41-48 µm or about 1.5 anal body-width long.

Vulva longitudinal. Female reproductive system amphidelphic. The exact shape of vagina not clear due to slight dorsoventral position, sclerotized distally. Uterus about five times longer than oviduct, the former partly glandular and partly muscular. Uterus and oviduct separated by the sphincter. Ovaries reflexed.

Tail elongate conoid, 241-252 µm or about 9 anal body-widths long, with three to four caudal pores on each side.

Male: Similar to female in general shape and morphology except the more curved posterior region and male genital system. Odontostyle 37 µm or about two lip region-widths long. Guiding ring 24 µm or about 1.3 head-width from anterior end. Odontophore 44 µm or 1.2 times the odontostyle length. Prerectum 487 µm or about 12 anal body-widths long, starts before the supplement region. Spicules 67 µm long when measured along the curved median line. Lateral guiding pieces rod-shaped, 10 µm long. In addition to the adanal pair, 27 ventromedian contiguous supplements present. Subventral papillae 11, spaced irregularly. Tail convex conoid with rounded terminus, 30 µm or about 0.8 anal body-width long, with 8 caudal pores on each side.

Type Habitat and locality: From soil around roots of citrus at Tarku, South Sikkim.

Differential diagnosis : Laimydorus coomansi sp. n. comes close to L. finalis Thorne, 1975 and L. baldus Baqri & Jana, 1982. From the former the present new species differs in having shorter odontostyle, anteriorly situated guiding ring and longer oesophagus (odontostyle = 45-46 µm, guiding ring 28 µm or 1.3 lip region width from anterior end, and b = 5.1-5.4 in L. finalis). Baqri (1986), while revising the species reported by Khera (1970), also identified the male of L. finalis for the first time from which the present male differs in having shorter spicules and lesser number of ventromedian supplements (spicules 105 µm and 47 ventromedian supplement in L. finalis after Baqri, 1986). From L. baldus it differs in having shorter body, odontostyle and odontophore (L = 2.1-2.3 mm; odontostyle = 31-35 µm, odontophore, 29-30 µm in L. baldus). The female further differs in the absence of pseudo 'Z' organs while the male having longer spicules (spicules = 53 µm in L. baldus).

The new species has been named after my teacher, Professor A. Coomans, Instituut voor Dierkunde, Rijksuniversiteit, Gent, Belgium.

FAMILY QUDSIANEMATIDAE JAIRAJPURI, 1965

GENUS LABRONEMELLA ANDRÁSSY, 1985

Labronemella hemicaudata sp.n.

(Fig. 15)

Measurements:

Holotype Female : L = 2.29 mm; a = 30.5; b = 4.5; c = 99; V = $^{20}_{54}{}^{14}$.

Paratype Female : L = 2.63 mm; a = 37; b = 5.0; c = 101; V = $^{15}_{49}{}^{16.5}$.

Paratype Male (1): L = 2.59 mm; a = 38; b = 4.7; c = 100; T = 60.

Description:

Female: Body ventrally curved posterior to vulva upon fixation. Cuticle finely striated, 4-5 µm thick in the mid-body and 10 µm thick on tail. Lateral hypodermal chords about 1/7th of body-width in the middle. Dorsal and ventral body pore 5 and 8 respectively, restricted in the oesophageal region. Lateral body pores counted 69 in one female; of which 20 in the oesophageal region, 40 in the intestinal region, 7 in prerectum and rectum region, and two in the caudal region.

Lip region somewhat discolsimoid type 22-23 µm wide and 7-8 µm high, off set by a constriction, slightly less than 1/3rd of body-width at base of oesophagus, with deeply sunk oral field and well separated inner liplets. The field of inner liplets about half of the head-width, 4-5 µm high. Amphids stirrup-shaped, their apertures 7-8 µm from anterior end and occupying 9 µm or 40% of corresponding body-width. Odontostyle 2.0-2.5 µm thick or about half of the corresponding cuticle thickness, 29-31 µm or about 1.3 head-width long; aperture 7-8 µm or about 1/4th of odontostyle length. Guiding ring 18-19 µm or about 0.8 lip region-width from anterior end. Odontophore 44-50 µm or 1.4-1.7 times the odontostyle length. Basal expanded part of oesophagus occupying 50-51% of the neck region. The positions of oesophageal gland nuclei and their orifices are as follows: DO = 49.3-52.5; DN = 52.4-55.2; DO-DN = 2.7-3.1; S_1N_1 = 72-79; S_2N = 87-89.5; S_2O = 90.5-91.6; K = 66-67; K' = 70-74. Nerve ring at 116-135 µm of 22-26% of the oesophageal length from anterior extremity. Cardia rounded, enveloped by intestinal tissue. Prerectum 130-182 µm or 3-4 anal body-widths long. Rectum 48-53 µm or slightly longer than one anal body-width.

Vulva a transverse slit. Vagina extending inward 28-31 µm or more than 1/3rd of corresponding body-width, sclerotized distally. Uterus and oviduct separated by the sphincter.

Ovaries reflexed; oocytes arranged in a single row, then in double rows and multiple rows in growth region. Egg 126 x 48 µm.

Tail rounded, 23-26 µm or about half of the anal body-width long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the male reproductive system and more ventrally curved posterior region. Odontostyle 30 µm long. Guiding ring 18 µm from anterior end. Odontophore 46 µm long. Prerectum 285 µm or about 6 anal body-widths long, starts before the supplement region. Spicules robust, 78 µm long along the median curved line. Lateral guiding pieces 12 µm long. In addition to the adanal pair, 18 ventromedian supplements present. Subventral papillae 9, spaced irregularly. Tail rounded, 26 µm or slightly more than half of the anal body-width long, with five caudal pores on each side.

Type habitat and locality: From soil around roots of citrus at Gyalshing, West Sikkim.

Differential diagnosis: Labronemella hemicaudata sp. n. comes close to Labronemella labiata Andrássy, 1985 which has been described only on a male. However, the male of present

new species differs in having lesser sunk field of inner lips, shorter odontostyle aperture and amphidial slits, longer spicules and prerectum in male (odontostyle aperture about 1/3rd, amphidial slits occupying more than 60% of the corresponding body-width, prerectum starts at the anterior most ventromedian supplement and spicules 65 µm long in L. labiata). Labronemella hemicoudata sp. n. also comes close to L. loofi (Ahmad & Jairajpuri, 1983) Andrássy, 1985 but differs in having lesser sunk field of inner lips, shorter odontostyle in relation to lip region-width and anteriorly situated guiding ring (odontostyle 1.6 lip region-width long and guiding ring one lip region-width from anterior end of body in L. loofi). The male of the present new species further differs from L. loofi in having longer spicules and prerectum (spicules 52-63 µm and prerectum starts at the mid-supplement region in L. loofi).

FAMILY NORDIIDAE JAIRAJPURI & SIDDIQI, 1964

GENUS ORIVERUTUS SIDDIQI, 1971

Oriverutus lobatus Siddiqi, 1971

(Fig. 16, A-E)

Oriverutus lobatus Siddiqi, 1971, Nematologica, 16 : 483-491.

Measurements:

Female (4): L = 0.62-0.73 mm; a = 20-24; b = 3.0-3.3; c = 10-14.5; V = 37-43.5[11-14].

Description:

Female: Body slightly ventrally curved in posterior half upon fixation, tapering gradually towards both ends. Cuticle finely striated, 2-3 µm thick (thickest on tail). Lateral hypodermal chords 1/4th-1/3rd of body-width near middle.

Lip region wider than adjoining body, marked by a distinct constriction; lips having prominent papillae. Amphids stirrup-shaped; apertures 5-6 µm from anterior end and occupying 6.0-6.5 µm or 65-66% of the corresponding body-width. Sensillar pouches 16-17 µm from amphidial slits. Odontostyle attenuated, 16-19 µm or 1.7-1.8 lip region-width long; aperture about 3 µm. Guiding ring 7-8 µm or 0.7-0.8 lip region-width from anterior extremity. Odontophore 18-19 µm long. The basal expanded part of oesophagus occupying 37-44% of neck region. Cardia with three lobes, enveloped by intestinal tissue. Nerve ring 78-92 µm from anterior end. Prerectum 18-34 µm or 1.1-2.2 anal body-widths long. Rectum 14-18 µm long. Vulva a transverse slit. Vagina 12-14 µm long, moderately sclerotized distally. Mono-opisthodelphic

reproductive system. Uterus and oviduct separated by sphincter.

Tail ventrally curved, conoid, horn-shaped in profile with narrow blunt terminus, 50-60 µm or 3.5 to 3.8 anal body-widths long, with one caudal pore on each side.

Habitat and localities: From soil around roots of citrus at Khumdong Basti, East Sikkim; Mangro Basti, South Sikkim; Gyalshing and Kabirthang, West Sikkim.

Oriverutus sundarus (Williams, 1964) Siddiqi, 1971

(Fig. 16, F-I)

Eudorylaimus sundarus Williams, 1964, Nematologica, 10: 319-322.

Oriverutus sundarus (Williams, 1964) Siddiqi, 1971, Nematologica, 16: 483-491.

Measurements:

Females (2): L = 0.86-0.87 mm; a = 29-32; b = 3.1-3.5; c = 15-16; V = 42-44 $^{13-15.4}$.

Description:

Female: Body ventrally curved in posterior half upon fixation, tapering gradually towards both ends. Cuticle finely

striated, 3-4 µm thick.

Lip region wider than adjoining body; lips distinct, large, subangular. Amphids stirrup-shaped; their apertures 5-6 µm from anterior end and occupying 5.5 µm or about 50% of the corresponding body-width. Odontostyle attenuated, 19 µm or about 1.6 lip region-width long; aperture about 3 µm. Guiding ring 7 µm from anterior end. Odontophore 19 µm or equal to the odontostyle length. The basal expanded part of oesophagus occupying 42-43% of neck region. Prerectum 48-56 µm or about 2.5-2.8 anal body-widths long, with a lobe extending behind prerectum-rectum junction. Rectum 22-25 µm long. Vulva a transverse slit. Reproductive system mono-opisthodelphic. Uterus and oviduct separated by sphincter.

Tail ventrally curved, conoid, horn-shaped in profile, with a narrow blunt terminus, 54-57 µm or about 2.8 anal body-widths long, with one caudal pore on each side.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Khumdong Basti, East Sikkim.

Remark : This species has already been redescribed by Baqri and Khera (1977) from district Darjeeling, W. Bengal (India).

Criverutus parangulatus sp. n.

(Fig. 17)

Measurements:

Sang population (type):

Holotype Female: L = 1.15 mm; a = 30; b = 3.6; c = 22; V = $^{14.7}_{52}{}^{15}$.

Paratype Female(2): L = 0.99-1.01 mm; a = 28-38; b = 3.6-3.7; c = 17-20; V = $^{14.5}_{50-53}{}^{14-15}$.

Tarku population:

Female (1): L = 1.01 mm; a = 27; b = 3.7; c = 17; V = $^{18}_{51.5}{}^{18}$.

Males (2): L = 0.98-1.16 mm; a = 30-32; b = 4.6-3.7; c = 20.5-22; T = 45-55.

Description:

Female: Body slightly ventrally curved at the posterior end upon fixation, tapering slightly towards both ends. Cuticle finely striated, 2-5 µm thick (thickest on tail). Lateral hypodermal chords slightly more than 1/3rd of body-width near middle. Dorsal and ventral body pores indistinct. Lateral body pores 24 (counted in holotype female), of which 8 in oesophageal region, 14 between cardia and anus and 2 in caudal region.

Lip region marked off by a constriction, wider than adjoining body, 6.0-6.5 µm high and 12-13 µm wide, with subangular lips bearing prominent papillae. Amphids large, stirrup-shaped; their apertures 6-7 µm from anterior extremity and occupying 6.5-7.5 µm or 56-57% of the corresponding body-width. Sensillar pouches 15-16 µm from amphidial slits. Odontostyle attenuated, 17-19 µm or 1.3-1.4 lip region-width long; its aperture 3-4 µm long. Guiding ring 6.5-7.5 µm or 0.5-0.6 head-width from anterior end. Odontophore 19-23 µm or 1.1-1.2 times the odontostyle length. The basal expanded part of oesophagus occupying 47-50% of the neck region. The locations of oesophageal gland nuclei and their orifices are as follows: DO = 56.2; DN = 60.0; DO-DN = 4.4; S_1N_1 = 70.6; S_1N_2 = 73.4; S_2N = 87; S_2O = 88; K = 78; K' = 84. Cardia with three lobes, enveloped by intestinal tissue. Nerve ring 100-115 µm or 36-37% of the neck region from anterior end. Prerectum 38-56 µm or 2.2-2.6 anal body-widths long. Rectum 18-25 µm or slightly longer than anal body-width.

Female reproductive system amphidelphic. Vulva a transverse slit. Vagina extending inward 14-16 µm or about 1/2 of the corresponding body-width, sclerotized distally. Uterus and oviduct separated by well developed sphincter muscles.

Ovaries reflexed; oocytes arranged in single row, then in double rows and multiple rows at the growth region.

Tail elongate conoid, tapering to a finely rounded terminus, 49-60 µm or 2.8-3.0 anal body-widths long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except in the male reproductive system. Odontostyle 19 µm. Guiding ring 7 µm from anterior end. Odontophore 19 µm. Pre-rectum 80-88 µm or about 3.1-4.0 anal body-widths long. Spicules 34-35 µm long along the curved median line. Lateral guiding pieces 6-7 µm long. In addition to the adanal supplement, six ventromedian supplements present which are spaced regularly.

Tail 46-56 µm or about 2.1-2.3 anal body-widths long, with two caudal pores on each side.

Type habitat and locality: From soil around roots of citrus at Sang, East Sikkim.

Tarku population: One female and two male from around roots of citrus at Tarku, South Sikkim.

Differential diagnosis: Oriverutus parangulatus sp. n. comes close to O. hastatus (Andrássy, 1963) Siddiqi, 1971 and

Q. arcuatus Baqri, 1980 in having amphidelphic female reproductive system and high lip region with subangular lips. It differs from Q. hastatus in having longer body, more angular lips, thinner cuticle, shorter odontostyle, longer odontophore than odontostyle, and distally sclerotized vagina (L = 0.75-0.84 mm, odontostyle 23-24 µm and odontophore shorter than odontostyle in Q. hastatus). It differs from Q. arcuatus in having longer body, more angular lips, longer odontostyle and odontophore, shorter and differently shaped female tail (L = 0.79-0.82 mm, odontostyle 13-14 µm, odontophore 13-16 µm, tail ventrally arcuate and 4 anal body widths long in Q. arcuatus). The male of Q. parangulatus can further be differentiated from Q. arcuatus in having smaller spicules, differently arranged and more number of ventromedian supplements (spicules 22 µm long medially, 3 ventromedian supplements of which first one is located in the spicular region in Q. arcuatus).

SAEVADORELLA SIDDIQI, 1982

Saevadorella intermoides sp.n.

(Fig. 18)

Measurements:

Holotype Female : $L = 0.66^{m}_{m}$; a = 17; b = 2.9; c = 20; $V = {}^{18}_{63}{}^{16}$.

Paratype Females (2): L = 0.59-0.64 mm; a=15-18; b = 2.7; c = 17-18; V = $^{17.5}_{64}{}^{15-18}$.

Paratype Males (3) : L = 0.61-0.67 mm; a = 19-21; b = 3.0-3.4; c = 16-20; T = 33-51.

Description:

Female: Body slightly curved upon fixation, gradually tapering towards both extremities. Cuticle transversely striated, 4.0-4.5 µm thick at the anterior end, 2.5-3.0 µm in mid-body, 5.0-5.5 µm at tail and 16-19 µm on the tail tip. Lateral hypodermal chords 1/4.7-1/3.5 body width near middle. Lateral body pores 34 in one female, out of which 9 in the oesophageal region, 23 between base of oesophagus and anus and 2 in the caudal region. Ventral and dorsal body pores few, restricted in the oesophageal region.

Lip region marked by a slight constriction, about 1/4th-1/3rd of body-width at base of oesophagus. Amphids stirrup-shaped, 6.0-6.5 µm from anterior end and occupying 6-7 µm or about 65-75% of the corresponding body-width. Odontostyle long and attenuated, 45-46 µm or about 4.5 head-widths long, aperture about 2 µm. Guiding ring 17-19 µm, 1.7-1.9 head-width from anterior end. Odontophore 42-48 µm or about one odontostyle length. Basal expanded part of oesophagus

37-38% of neck region. Positions of oesophageal gland nuclei and their orifices as follows: DO = 62.4-63; DN = 66.6; DO-DN 3.6-4.2; S_1N_1 = 78.5-81; S_1N_2 = 80.6-82.5; S_2N = 91-92; S_2O = 93-95; K = 90-92; K' = 84-93. Nerve ring 105-125 um or 50-53% of neck region from anterior end. Cardia rounded, surrounded by intestinal tissue. Prerectum 22-27 µm or 1.2-1.3 anal body-width long. Rectum 19-21 µm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 13-17 µm or about 1/3-1/2 of the corresponding body-width, with slightly sclerotized distal part. Female reproductive system amphidelphic. Ovaries reflexed. Uteri filled with sperms, mostly oval in shape, 3-4 µm long. Tail conoid with rounded tips, 33-35 µm or 1.6-1.8 anal body-width long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the reproductive system. Male reproductive system typical. Spicules 36-37 µm or 1.7-1.8 anal body-width long along the curved median line. Lateral guiding pieces 7-9 µm long. In addition to adanal pair, only one ventromedian supplement present, about 3 anal body-widths anterior to cloaca. Subventral papillae not seen. Prerectum 75-85 µm or about 4 anal body-widths long. Tail conoid, similar to

female, 34-38 µm or 1.7-1.8 anal body-width long, with two caudal pores on each side.

Type habitat and locality: From soil around roots of citrus at Gyalshing, West Sikkim.

Differential diagnosis: Saevadorella intermoides sp. n. comes close to S. saeva Siddiqi, 1982 but differs from it in having smaller body, differently shaped lip region, longer odontostyle and more posteriorly situated vulva (L = 0.7-0.9 mm; odontostyle 39-42 µm and V = 53-58 in S. saeva). The male of the present new species also differs in having only one ventromedian supplement.

ACEPHALODORYLAIMUS AHMAD & JAIRAJPURI, 1983

Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983

(Fig. 19)

Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983, Nematologica, 28: 233-246.

Measurements:

Females (3): L = 0.71-0.75 mm; a = 35-36; b = 3.6-4.0; c = 10.6-13.0; V = $^{10-13}_{52-53}$ $^{0.9-1.0}$

Description :

Female: Body 'C' shaped upon fixation, gradually tapering towards both extremities. Cuticle transversely striated, 1.5-2.0 µm thick. Lateral hypodermal chords slightly less than 1/3rd of body-width near middle. Lateral, ventral and dorsal body pores indistinct.

Lip region 7-9 µm wide and 4-5 µm high, rounded, marked by a slight constriction, about 1/2.2-1/2.8 body-width at base of oesophag us. Amphids stirrup-shaped, 4-5 µm from anterior end and occupying 4.5 µm or 50-60% of the corresponding body-width. Odontostyle attenuated, 12-14 µm or about 1.4-1.7 head-width long; aperture about 2.5 µm. Guiding ring 6.5-7.0 µm or about 0.8-1.0 head-width from anterior end. Odontophore 14-15 µm or slightly more than one odontostyle length. Basal expanded part of oesophagus 44-45% of the neck region. Positions of oesophageal gland nuclei and their orifices as follows: DO = 55.5-60.1; DN = 59-63; DO-DN = 2.9-3.5; S_1N_1 = 71-72; S_1N_2 = 77-79; S_2N = 88; S_2O = 90.0-90.4; K = 61-64; K' = 67-71. Nerve ring 75-80 µm or 36-42% of neck region from anterior end. Cardia rounded, enveloped by intestinal tissue. Prerectum 33-50 µm or about 3.0-4.5 anal body-widths long. Rectum 10-11 µm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 8-9 µm or about 1/2.5 of the corresponding body-width, with slight sclerotized distal part. Female reproductive system mono-prodelphic, comprising the usual parts. Ovary reflexed, short; oocytes arranged first in single, then in double and multiple rows at growth region.

Tail elongate conoid, ventrally arcuate, with rounded tip, 58-68 µm or about 5.3-6.2 anal body-widths long; with two caudal pores on each side.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Tekgehri, South Sikkim.

Remarks: Ahmad & Jairajpuri (1983) described the new genus and species Acephalodorylaimus attenuatus having narrow-conoid and truncated lip region with slightly projecting labial papillae, long and attenuated odontostyle, simple rod-like odontophore, basal expanded part of oesophagus about half of the neck region, mono-prodelphic female reproductive system, and elongate-conoid ventrally arcuate tail.

The present author has studied two paratypes of A. attenuatus and confirmed that the shape of lip region is exactly similar to the specimens from Tekgehri, South Sikkim. In view of the above observations, the diagnosis of the genus is to be amended accordingly.

GENUS ACEPHALODORYLAIMUS AHMAD & JAIRAJPURI, 1983

Diagnosis (amended): Nordiidae. Lip region high, rounded, and amalgamated. Odontostyle long and attenuated. Odontophore simple, rod-like. Basal expanded part of oesophagus about half of the neck region. Vulva transverse. Female reproductive system mono-prodelphic. Tail elongate conoid, ventrally arcuate.

Type and only species: Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983.

FAMILY THORNENEMATIDAE SIDDIQI, 1969

GENUS OPISTHODORYLAIMUS AHMAD & SIDDIQI, 1982

Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1985

(Fig. 20, A-D)

Dorylaimus cavalcantii Lordello, 1955, Rev. Bras. Biol. 15: 211-218.

Thornenema cavalcantii (Lordello, 1955) Andrássy, 1959, Acta.

Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1985, Nematologica, 31: 379-408.

Measurements:

Females (10): L = 0.91-1.2 mm; (p.99); a = 24-34 (28); b = 4.0-4.6 (4.2); c = 11-18 (13.5); V = 43-47 (45) 11-16 (12.5).

Male (1): L = 1.19 mm; a = 31; b = 4.7; c = 56.5; T = 50.

Description:

Baqri and Khera (1977), while describing the variations in Thorneneme cavalcantii (= O. cavalcantii) including abnormal development of didelphic reproductive system, had also included a population from Singtam, East Sikkim. All the present female specimens fall within the same range. The random survey has revealed that O. cavalcantii is a widely distributed species in Sikkim State. The present author has also been able to collect a single male from Sikkim which is described hereunder.

Male: Similar to female in general shape and morphology except in tail shape and male genital system. Spicules 40 µm or 1.7 anal body-width long when measured along the curved median line. Lateral guiding pieces rod-shaped, 8 µm long. In addition to the adanal pair, 9 irregularly spaced ventro-

median supplements present. The first ventromedian supplement situated at about 1.9 anal body-width from cloacal opening. Subventral papillae not distinct. Copulatory muscles 28, reaching up to the last supplement. Prerectum 172 µm or about 7.5 anal body-widths along. Tail convex-conoid with bluntly rounded terminus, 21 µm or 0.9 anal body-width long; with 6 caudal pores on each side.

Habitat and locality: A single male along with females was collected from soil around roots of citrus at Tekgehri, South Sikkim.

Other localities: Khumdong Basti, Sang, Majirtar and Namli Gardens in East Sikkim; Nalam in South Sikkim; Gyalshing, Yangthang, Yangthang Tik Juk, Chongshah and Geyzing West in West Sikkim.

Remarks: The present male differs from the male described by Ahmad and Jairajpuri (1982) in having slightly longer spicules and more ventromedian supplements (spicules 35 µm long and 5 ventromedian supplements after Ahmad and Jairajpuri).

GENUS SCLEROLABIA CARBONELL & COOMANS, 1985

Sclerolabia salmae sp. n.

(Fig. 20, E-I)

Measurements:

Holotype (Female) : L = 0.91 mm; a = 26; b = 4.8; c = 35; V = $40^{11.7}$.

Paratype Female (1): L = 0.98 mm; a = 28; b = 4.6; c = 39; V = 40^{10}.

Description:

Female: Body slightly ventrally curved posterior to vulva when fixed, and tapering towards both ends. Cuticle finely striated, 2-4 µm thick (thickest on tail). Body pores difficult to observe. Lateral hypodermal chords 1/7th of body-width near middle. Lip region rounded, flat at apex, marked by a slight depression. Labial framework and post-labial sclerotization moderately developed. Amphids stirrup-shaped, their apertures 5.5 µm from anterior end and occupying 5.5 µm or about half of the corresponding body-width. Sensillar pouches 15-16 µm from amphidial slits.

Odontostyle cylindrical, 13-14 µm or 1.3-1.4 head-width long; aperture about 35% of the odontostyle length. Guiding ring 8 µm or 0.8 head-width from anterior end. Odontophore

poorly demarcated, 17-18 µm or about 1.5 times the odontostyle length. Basal expanded part of oesophagous about 30% of the neck region. Positions of the oesophageal gland nuclei and their orifices as follows: DO = 72.6; DN = 74.7; DO-DN = 2.1; S_1N_1 = 78.4; S_1N_2 = 82; S_2N = 85.5; S_2O = 87.5; K = 54; K′ = 65. Nerve ring 95-98 um from anterior end. Cardia rounded, enveloped in the intestinal tissue. Prerectum 42-46 µm or about 2.5 anal body-widths long. Rectum 16-17 µm or about one anal body-width long.

Female reproductive system mono-opisthodelphic. Anterior uterine sac less than half of the corresponding body-width. Vulva a transverse slit. Vagina thick-walled, extending inward about half of the body-width. Female reproductive system mono-opisthodelphic. Posterior sexual branch normal. Uterus containing a few sperms. Oviduct and uterus separated by a well developed sphincter. Oocytes first arranged in a single row, then in double rows and multiple rows in the growth region.

Tail rounded, cylindrical, 25-26 µm or about 1.5 anal body-width long, with two caudal pores on each side.

Male: Not found.

Type habitat and locality: From soil around roots of citrus near Gangtok, East Sikkim.

Differential diagnosis: Sclerolabia salmae sp. n. comes close to Sclerolabia indica (Baqri and Jairajpuri, 1967) Corbonell and Coomans, 1985 but differs from it in having lip region with flat apex, longer odontostyle and odontophore, tail about one and a half anal body-width long, and anteriorly situated vulva (odontostyle 9-11 µm, odontophore 14-16 µm, tail about one anal body-width long, V = 48-49 in S. indica).

The species has been named after my mother, Mrs. Umme Salma Baqri.

FAMILY APORCELAIMIDAE HEYNS, 1965

GENUS APORCELAIMELLUS HEYNS, 1965

Aporcelaimellus atheri sp.n.

(Fig. 21)

Measurements:

Holotype Female : L = 1.10 mm; a = 43; b = 4.0; c = 26; V = $51^{9.8}$.

Paratype Female (1): L = 1.50 mm; a = 51; b = 5.0; c = 43; V = $51^{9.2}$.

Description:

Female: Body ventrally curved upon fixation, tapering slightly towards both ends. Cuticle distinctly striated, 1.5-4.0 µm thick (thickest on tail). Lateral hypodermal chords 1/6th-1/5th of body-width near middle. Lateral, dorsal and ventral body pores indistinct.

Lip region distinctly offset by a constriction, 3.5 µm high, 7.5-8.5 µm wide, wider than adjoining body, about 1/3.5 of body-width at base of oesophagus. Amphids stirrup-shaped; apertures 5 µm wide and 3.5 µm from anterior extremity. Sensillar pouches 10 µm from amphidial slits. Odontostyle 9 µm or 1.1-1.2 lip region-width long; aperture 5.5 µm or about 60% of odontostyle length. Guiding ring 4.5 µm or about half lip region-width from anterior end. Odontophore 14-16 µm or 1.5-1.7 times the odontostyle length. Basal expanded part of oesophagus occupying 43-44% of the neck region. Oesophageal gland nuclei and their orifices in one specimen as follows: DO = 57.1; DN = 60.3; DO-DN = 3.2; S_1N_1 = 74; S_1N_2 = 78.8; S_2N = 87.4; S_2O = 88.4; K = 81; K' = 79. Cardia rounded, enveloped by intestinal tissue. Nerve ring 99-102 µm or 32-35% of the neck region from anterior end. Prerectum 50-72 µm or 3.0-4.5 anal body-widths long. Rectum 20-22 µm or 1.2 anal body-width long.

Female reproductive system mono-opisthodelphic. Vagina 11-12 µm or about 1/2.5 body-width long. Uterus and oviduct separated by sphincter. Sperms not seen. Ovaries reflexed; oocytes arranged first in a single row, then in double rows and multiple rows at growth region.

Tail convex conoid, 35-42 µm or 2.2-2.3 anal body-widths long, with rounded tip and two caudal pores on each side.

Male: Not found.

Type and habitat and locality: From soil around roots of citrus at Khumdong Basti, East Sikkim.

Differential diagnosis: Aporcelaimellus atheri sp. n. is distinct from all the known species of the genus in having mono-opisthodelphic reproductive system in female.

This new species is named after Prof. Ather H. Siddiqi, Chairman of the Zoology Department, Aligarh Muslim University, Aligarh.

SUPERFAMILY ACTINOLAIMOIDEA THORNE, 1939 (THORNE, 1967)

FAMILY NEOACTINOLAIMIDAE THORNE, 1939

GENUS NEOACTINOLAIMUS THORNE , 1967

Neoactinolaimus agilis Thorne, 1967

(Fig. 25, I-L)

Neoactinolaimus agilis Thorne, 1967, Agric. Exp. Stat. Univ. Puerto Rico, 43: 1-48.

Measurements:

Terku population:

Female (1): L = 2.76 mm; a = 41; b = 5.0; c = 11.8;
V = $^{18}44.8^{19}$.

Male (1) : L = 2.30 mm; a = 41; b = 4.1; c = 100; T = 40.

Khumdong population:

Female (1): L = 2.45 mm; a = 55; b = 4.4; c = 15.3;
V = $^{14.5}55^{15}$.

Description:

Female: Body nearly straight upon fixation, tapering slightly towards both ends. Cuticle finely striated transversely, 2.5-6.5 µm thick (thickest on tail). Lateral hypodermal chords about 1/6th of body-width near middle.

Lip region slightly wider than adjoining body, with amalgamated lips. Amphids stirrup-shaped, 9 µm from anterior end and occupying 7 µm or more than 1/3rd of the corresponding body width. Cheilostome wall moderately sclerotized, armed with four onchia. Denticles absent. Odontostyle 24-26 µm or 1.2-1.3 lip region-width long; aperture slightly less than half of the odontostyle length. Guiding ring 18-20 µm or 0.9-1.0 lip region-width from anterior extremity. Odontophore 26-28 µm or 1.0-1.2 odontostyle length. Basal expanded part of

oesophagus occupying about 50% of the neck region. Nerve ring 160-172 µm or about 30% of the oesophageal length from anterior end. Prerectum 192-210 µm or 6-7 anal body-widths long. Rectum 40-43 µm or 1.3-1.4 anal body-width long. Female reproductive system amphidelphic. Vulva pore-like. Oviduct and uterus separated by sphincter.

Tail elongate, tapering gradually, 160-234 µm or 5.1-7.5 anal body-widths long, with rounded tip and five caudal pores on each side.

Male: Similar to female in general shape and morphology except in tail shape and male genital system. Odontostyle 24 µm. Guiding ring 20 µm or slightly more than one head-width from anterior end. Odontophore equal to odontostyle length. Spicules 56 µm long along the curved median line. Lateral guiding pieces 10 µm long. In addition to the adanal pair, 13 ventromedian supplements present; the latter arranged in two groups (fascicles) of six each, and one in between the fascicles. Subventral papillae 9, spaced irregularly. Prerectum 280 µm or 9 anal body-widths long. Tail short, 23 µm long, with bluntly rounded terminus and five caudal pores on each side.

Habitat and locality: One male and a female collected from soil around roots of citrus at Tarku, South Sikkim. A single female was collected from Khumdong, East Sikkim.

SUPERFAMILY LONGIDOROIDEA THORNE, 1935 (KHAN & AHMAD, 1975)

FAMILY XIPHINEMATIDAE DALMASSO, 1969

GENUS XIPHINEMA COBB, 1913.

Xiphinema insigne Loss, 1949

(Fig. 22, A-D)

Xiphinema insignis Loss, 1949; J. Zool. Soc. India, 1: 23-29.
Xiphinema indicum, Siddiqi, 1959, Proc. Helminth. Soc. Wash., 26: 151-163.
Xiphinema insigne of Luc & Tarjan, Nematologica, 9: 111-115.

Measurements:

Females(10): L = 2.00-2.44 mm (2.23); a = 39-53 (43);
b = 5.2-7.3 (6.1); c = 16.2-20.1 (18.1);
V = $^{6.1-8.3\ (7.7)}_{28-31(29)}$ $^{7.8-10.7(9)}$.
Odontostyle = 100-114 µm; Odontophore=63-70 µm.

Description:

Female: Body slightly ventrally curved posterior to vulva, tapering slightly towards both extremities. Cuticle about 4 µm thick at head, 2-3 µm in the mid-body and 6-7 µm thick at tail region. Lateral hypodermal chords 1/6-1/8 of body-width near middle.

Lip region almost flat or rounded, slightly marked by a depression. Amphids stirrup-shaped; their apertures 5.0-5.5 µm

wide and 5-6 µm from anterior end. Sensillar pouches 18-20 µm from aphidial slits. Odontostyle 8.7-9.1 lip region-widths long. Fixed guiding ring 86-98 µm or 7.2-8.0 lip region-widths from anterior end. Odontophore 0.56-0.70 times the odontostyle length. Cardia short and conoid. Prerectum 403-634 µm or 18-26% of the total body length and 17-23 times the anal body-width. Rectum 22-23 µm or 1.2-1.5 anal body-width long. Female reproductive system amphidelphic. Vagina 19-20 µm or less than 1/2 of corresponding body-width long. Uterus and oviduct separated by sphincter. Ovaries reflexed.

Tail conoid with rounded tip, ventrally arcuate, 104-125 µm or 4.2-5.0 anal body-widths long, with 2-3 caudal pores on each side.

Male: Not found.

Habitat and localities: From soil around roots of citrus at Bong Khumdong Basti, Turung, Samdur, and Namli Gardens in East Sikkim; Nalam, Namthang, Tekgehri in South Sikkim; Geyzing West, Yangthang and Gyalshing in West Sikkim.

Xiphinema brevicolle Lordello & Costa, 1961

(Fig. 22, E-I)

Xiphinema brevicolle: Lordello & Costa, 1961, Rev. Brasil. Biol., 21: 363-366.

Xiphinema reversi, Dalmasso, 1969, Mem. Mus. natn. Hist. nat. Paris, 61: 33-82.

Xiphinema soapaloense Khan & Ahmad, 1975, Nematol. medit., 1: 23.

Measurements:

Females (10: L = 1.78-1.95 mm (1.88); a = 34-43 (37);
b = 5.5-5.8 (5.6); c = 59-72 (64);
V = $^{6.5-9.7(8.6)}_{52-69(55)}{}^{6.5-15(9.6)}$;
Odontostyle = 103-114 µm; Odontophore=53-59 µm.

Description:

Female: Body 'C' shaped upon fixation, tapering, slightly towards both extremities, cuticle finely striated, 3-15 µm thick (thickest on tail tip). Lateral hypodermal chords about 1/5-1/4 of body-width near middle.

Lip region flattened, marked by a slight depression. Amphids stirrup-shaped; their apertures 5-6 µm from anterior end, 5-6 µm wide or 42-50% of the corresponding body-width. Sensillar pouches 15-16 µm from amphidial slits. Odontostyle

8.6-9.5 lip region-widths long. Guiding ring 75-87 µm or 6.2-7.2 lip region-widths from anterior end. Odontophore about 1/2 times the odontostyle length. Basal expanded part of oesophagus 17-20% of the oesophageal length or 1.4-1.8 times the corresponding body-width. Cardia short, conoid. Prerectum 118-160 µm or 5.0-6.7 anal body-widths long. Rectum 22-26 µm or about one anal body-width long. Female reproductive system amphidelphic. The uterus and oviduct separated by sphincter. Ovaries generally reflexed. However, the anterior sexual branch in one specimen has taken turn to posterior of vulva (fig. 22, G) while in another specimen the posterior sexual branch has taken turn to anterior side (Fig. 22, H). The ovaries are also outstretched in two specimens having twisted sexual branches. The oocytes arranged in a single row except in the growth region.

Tail short conoid, 27-30 µm or 1.0-1.3 anal body-width long, with two caudal pores on each side.

Male: Not found.

Habitat and localities: From soil around roots of citrus at Mangro Basti, Tarku and Kwezing, South Sikkim and Gyalshing, Yangthang, West Geyzing in West Sikkim.

Remarks: Jairajpuri & Siddiqi (1963) found this species from Dalhousie, Himachal Pradesh, India. Bajaj & Jairajpuri (1979) stated that the species is highly variable specially in tail shape (from short, rounded to conoid) and the lip region. The latter authors also considered X. reversi Dalmasso, 1969 and X. saopaloense Khan & Ahmad, 1975 as synonym of X. brevicolle.

SUPERFAMILY BELONDIROIDEA THORNE, 1939

FAMILY BELONDIRIDAE THORNE, 1939

GENUS DORYLAIMELLUS COBB, 1913

Dorylaimellus indicus Siddiqi, 1964

(Fig. 23, A-C)

Dorylaimellus indicus Siddiqi, 1964, Labdev. J. Sci. Tech., 2: 37-41.

Measurements:

Females (5): L = 1.48-1.61 mm; a = 46-52; b = 8.2-9.0; c = 45-48; V = $^{7-9}(50-52)^{6-8}$.

Description:

Female: Body curved ventrally, tapering gradually towards both extremities. Cuticle striated, 1.5-2.5 µm thick (thickest

on tail). Lateral hypodermal chords about 1/4th of body-width near middle. Lateral glandular organs 90-97, irregular in arrangement. Head off set, about 1/4th of body-width at base of oesophagus. Amphids about 5 µm wide and 4 µm from anterior extremity. Sensillar pouches 16-17 µm from amphidial slits. Odontostyle 7 µm, its aperture about 1/3rd of odontostyle length. Odontophore 12-13 µm long. Basal expanded part of oesophagus about 25% of the total oesophageal length.

Vulva longitudinal. Vagina 10-12 um long. Female reproductive system amphidelphic. Prerectum about three anal body-widths long. Rectum about 3/4th of anal body-width long. Tail cylindrical, with bluntly rounded terminus, about 1.5-1.6 anal body-width long.

Habitat and locality: From soil around roots of citrus at Sajung, East Sikkim.

Dorylaimellus murtazai sp. n.

(Fig. 23, D-G)

Measurements:

Nemli Population (type):

Holotype Female : L = 1.39 mm; a = 38; b = 7.8; c = 18.3; V = $^{10}50^{9}$.

Paratype Female (1): L = 1.25 mm; a = 45; b = 7.8; c = 17.2; V = $^{10.3}_{46}{}^{8.8}$.

Khumdog Population:

Female (1): L = 1.32 mm; a = 36; b = 7.6; c = 18; V = $^{9}_{47}{}^{8}$.

Description:

Female: Body ventrally curved in the posterior half upon fixation, tapering slightly towards both ends. Cuticle distinctly striated, 1.5-3.0 µm thick (thickest at tail). Lateral hypodermal chords about 1/4th of body-width near middle. Lateral glandular organs 38-44 in number, of which 8-10 occur in the neck region.

Lip region 7.5-9.0 µm wide and 3-4 µm high, offset by a distinct constriction, 1/3rd-1/4th of the body at base of oesophagus; lips conoid. Cuticularized pieces present around vestibule. Odontostyle attenuated, 7-8 µm long; its aperture 1.5 µm. Guiding ring weak, 5.0-5.5 µm from anterior end. Odontophore flanged, 12-13 µm or 1.5-1.8 times the odontostyle length. Anterior slender part of oesophagus typically gradually expands between the base of odontophore and nerve ring and then narrows. Basal expanded part of oesophagus occupying

32-37% of the neck region, enclosed in muscle sheath. Oesophageal gland nuclei and their orifices indistinct. Cardia rounded, enveloped by intestinal tissue. Nerve ring 68-75 µm or 42-43% from anterior end of body. Prerectum-intestine junction obscure, 33-40 µm long. Rectum 20-22 µm or about one anal body-width long.

Vulva longitudinal; vagina extending inward 10-12 µm or about 1/3rd of the corresponding body-width. Female reproductive system amphidelphic. Uteri filled with sperms in holotype.

Tail elongate conoid, slightly curved ventrally, 73-76 µm or 3.1-3.6 anal body-widths long, with two to three caudal pores on each side.

Male: Not found.

Type habitat and locality: From soil around roots of citrus at Namli gardens before Ranipul, East Sikkim.

Khumdog population: From soil around roots of citrus at Khumdog Basti, East Sikkim.

Differential diagnosis: Dorylaimellus murtazai sp. n. differs from closely related species D. himalayensis in having

shorter oesophagus, basal expanded part of oesophagus, odontostyle and odontophore (b = 4.2-4.9, basal expanded part of oesophagus occupying more than 50% of the neck region, odontostyle 10-12 µm and odontophore 17-18 µm in D. himalayensis). The present new species further differs in having lesser number of lateral glandular organs (58-66 in D. himalayensis) and differently shaped tail (tail ventrally arcuate in D. himalayensis).

The present new species has been named after my father, late S. Hasan Murtaza Baqri.

FAMILY AXONCHIIDAE THORNE, 1964 (SIDDIQI, 1968)

GENUS AXONCHIUM COBB, 1920

Axonchium (Axonchium) phukani Rahman, Jairajpuri & Ahmad, 1985

(Fig. 26, A-C)

Axonchium (Axonchium) phukani Rahman, Jairajpuri and Ahmad, 1985, Nematologica, 31: 13-25.

Measurements:

Females (10): L = 1.44-1.85 mm (1.60); a = 39-46 (42);
b = 2.7-3.0 (2.8); c = 58-82 (69);
V = $\overset{5.5\text{-}8.7(7.5)}{54.9\text{-}58.6\ (56.2)}$ $\overset{10\text{-}15(13)}{}$.

Males (5): L = 1.49-1.81 mm (1.62); a = 35-42 (37);
b = 2.8-3.0 (2.9); c = 53-64 (57); T = 51-54 (52).

Description:

Female: Body slightly curved ventrally upon fixation, tapering anterior to basal expanded part of oesophagus. Cuticle 2-11 µm thick at various places of body (thickest on tail tip). Lateral hypodermal chords 1/10-1/8th of body-width near middle.

Lip region off set by a contriction, about 1/6.5-1/5th of body-width at base of oesophagus. Amphids cup-shaped, about 6 µm wide and 3-4 µm from anterior end of body. Odontostyle fusiform, 10-11 µm long. Guiding ring 8-9 µm from anterior end. Odontophore of 12-13 µm long. Anterior slender part of oesophagus separated from basal expanded portion by a typical constriction. Basal expanded part of oesophagus slightly muscular, occupying 61-65% of the neck region, and enclosed in a muscle sheath with almost straight bundles. Nerve ring 116-124 µm long from anterior end. Prerectum 221-295 µm or 7-10 anal body widths. Rectum 27-31 µm long.

Vulva a transverse slit. Vagina slightly bent posteriad, slightly less than 1/2 of the corresponding body-width, anterior uterine sac 104-146 µm or about 2.3-3.4 corresponding body-width long. Posterior sexual branch normal. Uterine egg 124x30 µm. Tail broadly rounded, 21-27 µm long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the male genital system. Spicules 37-42 µm long along the curved median line. Lateral guiding pieces 8-10 µm long. Supplements an adanal pair and 5-6 ventromedians. Prerectum 223-335 µm or 7.5-11.0 anal body-widths long. Tail broadly rounded, 28-29 µm long, with two caudal pores on each side.

Habitat and locality : From soil around roots of citrus at Sang, East Sikkim.

SUPERFAMILY TYLENCHOLAIMOIDEA FILIPJEV, 1934

FAMILY TYLENCHOLAIMIDAE FILIPJEV, 1934

GENUS TYLENCHOLAIMUS DE MAN, 1876

Tylencholaimus pakistanensis Timm, 1964

(Fig. 24, G-I)

Tylencholaimus pakistanensis Timm, 1964, Proc. Helminth. Soc. Wash., 31: 144-153.

Measurements:

Females (5) : L = 0.38-0.40 mm; a = 22-25; b = 3.4-3.6; c = 31-36; V = 44-46 $^{15.0-22.5}$.

Description:

Female: Body ventrally curved upon fixation, tapering slightly

towards both ends. Cuticle distinctly striated, 1.2-3.5 µm thick (thickest on tail). Lateral hypodermal chords about 1/4th of body-width near middle.

Lip region slightly off set from body, about 1/2.5 of body-width at base of oesophagus. Amphids stirrup-shaped; apertures 3.0-3.5 µm wide and 3 µm from anterior end. Odontostyle 6.5-7.0 µm or about 1.0-1.1 head-width long; aperture 2.0-2.5 µm. Guiding ring 4.5-5.0 µm from anterior end. Odontophore with small basal knobs, 8.5-9.0 µm or about 1.2-1.4 times the odontostyle length. Basal expanded part of oesophagus occupying 31-34% of neck region. Cardia rounded. Nerve ring 52-55 µm or 43-46% of the oesophageal length from anterior end. Rectum 11-12 µm or more than one anal body-width long. Prerectum 16-18 µm or about 1.5 anal body-width long. Female reproductive system mono-opisthodelphic. Vagina inclined posteriorly, 6 µm or about 1/3rd of the corresponding body-width. Ovaries reflexed. Uterus and oviduct not separated distinctly. Tail hemispherical, 9.5-11.0 µm or slightly more than one anal body-width long, with one caudal pore on each side.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Khumdeng Basti, East Sikkim.

Remarks: The present population fits well with the original measurements and description of Tylencholaimus pakistanensis provided by Timm (1964). However, it differs in having less expanded lip region and hemispherical tail tip (tail subconoid after Timm).

Tylencholaimus obscurus Jairajpuri, 1965

(Fig. 24, A-C)

Tylencholaimus obscurus Jairajpuri, 1965, Nematologica, 10: 512-518.

Measurements:

Female (2): L = 0.76-0.77 mm; a = 35-37; b = 3.6-3.8; c = 45-48; V = $^{20-22}_{71-72}$.

Description:

Female: Body ventrally curved in posterior half upon fixation, tapering towards both ends. Cuticle 1.2-3.5 µm thick (thickest on tail). Outer layer of cuticle smooth, inner layer transversely striated, loosened irregularly from outer layer. Lateral hypodermal chords about 1/4th of body-width near middle.

Lip region offset by a constriction, its inner portion slightly projected. Amphids stirrup-shaped, their apertures 3.5 µm wide and 3.5 µm from anterior end. Sensillar pouches 10 µm from amphidial slits. Odontostyle 6 µm; aperture occupying about 1/3rd of odontostyle length. Guiding ring 4.5 µm from anterior end. Odontophore with basal knobs, 6.5 µm long. Basal expanded part of oesophagus about 33-35% of the neck region. The nerve ring 70-85 µm from anterior end. Prerectum 26-31 µm or about two anal body-widths long. Rectum 11 µm or less than one anal body-width long. Female reproductive system monoprodelphic. Anterior sexual branch normal. Posterior uterine sac absent.

Tail short with bluntly rounded terminus, about 1.3 anal body width long.

Male: Not found.

Habitat and locality: Soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks: The present population differs from the original description of I. obscurus in having more rounded tail terminus.

Tylencholaimus micronanus Yeates, 1979

(Fig. 24, D-F)

Tylencholaimus micronanus Yeates, 1979, Nematologica, 25: 419-438.

Measurement:

Female (1): L = 0.44 mm; a = 25; b = 3.6; c = 34.5; V = $^{15}70$.

Description:

Female: Body ventrally curved in its posterior half upon fixation. Cuticle without distinct markings, about 2 µm thick. Lateral hypodermal chords about 1/3rd of body-width near middle.

Lip region conical without distinct papillae. Odontostyle 6 µm long. Guiding ring 3.5 µm from anterior end. Odontophore with basal knobs, equal to the length of odontostyle. Basal expanded part of oesophagus about 1/3rd of the neck region. Nerve ring 54 µm from anterior end. Cardia rounded. Prerectum poorly marked, slightly more than two anal body-widths long. Rectum about one anal body-width long. Female reproductive system mono-prodelphic. Vagina at right angle to the body axis, extending inward slightly less than 1/3rd of corresponding body-widths. Anterior sexual branch normal. Post-vulval sac absent.

Tail cylindroid with rounded terminus, 13 µm or about one anal body-width long. Caudal pores indistinct.

Male: Not found.

Habitat and locality: From soil around roots of unidentified grasses and citrus at Sukhe Khola, near Gangtok, East Sikkim.

Remarks: The present single female fits well with the description and illustrations of I. micronanus provided by Yeates (1979).

GENUS DICOMYCTUS THORNE, 1939

Discomyctus cephalatus Thorne, 1939

(Fig. 27, G-J)

Discomyctus cephalatus Thorne, 1939, Capita Zool., 8: 261 pp.

Measurements:

Female (1): L = 0.82 mm; a = 37; b = 3.2; c = 6.7; $V = {}^{10.3}_{57}$.

Description:

Body slightly curved upon fixation. Cuticle finely striated, 2.0-2.5 µm thick. Lateral hypodermal chords about

1/3rd of the body-width near middle.

Lip region off set from adjoining body by a slight constriction with the typical prominent disc. Amphids cup-shaped, apertures occupy 4 µm or 57% of the corresponding body-width. Sensillar pouches 9 µm from amphidial slits. Odontostyle 8 µm or 1.1 head-width long; aperture 2 µm or 1/4th of the odontostyle length. Guiding ring about 4 µm from anterior extremity. Odontophore 10 µm or about 1.2 times the odontostyle length, knobbed basally. Basal expanded part of oesophagus occupying 52% of the neck region. Nerve ring 73 µm from anterior end. Rectum 16 µm or less than one anal body-width long. Vulva a transverse slit. Vagina 10 µm long. Female reproductive system mono-prodelphic. Posterior uterine sac absent.

Tail elongate-conoid, 123 µm or 7.3 anal body-widths long, with rounded terminus; 3 caudal pores on each side.

Habitat and locality: From soil around roots of citrus, at Namli Garden on Siliguri-Gangtok Highway, East Sikkim.

Remark : The present specimen differs from the original description and illustration in the absence of offset anterior disc by a constriction.

FAMILY LEPTONCHIDAE THORNE, 1935

GENUS PROLEPTONCHUS LORDELLO, 1955

Proleptonchus clarus Timm, 1964

(Fig. 25 A-D)

Proleptonchus clarus Timm, 1964, Proc. Helminth. Soc. Wash. 31: 144-153.

Measurements:

Females (5): L = 1.24-1.38 mm (1.30); a = 31-34 (32);
b = 6.2-7.4 (6.7); c = 81-104 (91);
V = 19-20.5(19.5)$_{55-58(56)}$4.0-5.4(4.6).

Description:

Female: Body slightly curved in the posterior half of its length upon fixation. Cuticle 2.5-6.0 µm thick (thickest on tail); subcuticle coarsely striated. Lateral hypodermal chords 1/10th-1/7th of body-width near middle.

Lip region slightly off set from body, lips amalgamated, about 1/3rd of body-width at base of oesophagus. Amphids 5 µm from anterior end and 7-8 µm wide. Stoma flask-shaped. Odontostyle slender, 8-9 µm long. Guiding ring 7.5-9.0 µm from anterior end. Odontophore 11-12 µm long. Oesophagus slender, terminating in a constricted oesophageal bulb. Cardia low. Nerve ring 84-95 µm from anterior end. Prerectum 116-138 µm

or 4-5 anal body-widths long. Rectum about one anal body-width long. Vulva a transverse slit. Vagina extending inward 16-19 µm or slightly less than half of the corresponding body-width. Female reproductive system mono-prodelphic. Posterior uterine sac 51-68 µm or 1.1-1.7 times the corresponding body-width. Oviduct and uterus separated by well developed sphincter. Sperms present in oviduct. Ovary reflexed.

Tail rounded, 12-16 µm or 0.5-0.6 anal body-width long.

Male: Not found.

Habitat and localities: From soil around roots of citrus at Yangthang and Guruthang near Gyalshing, West Sikkim.

FAMILY BELONENCHIDAE THORNE, 1964

GENUS TYLEPTUS THORNE, 1939

Tyleptus variabilis Jairajpuri & Loof, 1966

(Fig. 25, E-H)

Tyleptus variabilis Jairajpuri & Loof, 1966, Proc. Helminth. Soc. Wash., 33: 84-86.

Measurements:

Females(3): L = 0.81-0.89 mm; a = 32-33; b = 4.2-4.7; c = 86-96; V = $^{2.8-4.3}_{29-33}{}^{21-27}$.

Males (2): L = 0.77-0.80 mm; a = 27-29; b = 3.8;
c = 57-60; T = 52-54.

Description:

Female: Body slightly ventrally curved upon fixation. Cuticle finely striated, about 2 µm thick. Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region slightly off set from body, liplets distinct around oral opening, 1/2.3-1/2.8 of body-width at base of oesophagus. Amphids cup-shaped, 4.0-4.5 µm from anterior end and 6.5-7.0 µm wide. Stoma short, slightly sclerotized. Odontostyle 7-8 µm or 0.7-0.8 lip region-width long; aperture about 1/4th of odontostyle length. Guiding ring 5.0-5.5 µm from anterior end. Odontophore flanged, 8.0-9.5 µm or 1.0-1.3 times the odontostyle length. Oesophagus slender, terminating in a pyriform bulb. Cardia rounded. Nerve ring 72-88 µm from anterior end. Prerectum 50-66 µm or about 2.5-3.0 anal body-widths long. Rectum slightly longer than one anal body-width. Vulva a transverse slit. Vagina 12-13 µm or less than one half of the corresponding body-width. Female reproductive system mono-opisthodelphic. Anterior uterine sac 25-36 µm or 1.0-1.4 of the corresponding body-width. Posterior sexual branch normal. Oviduct and uterus separated by sphincter.

Tail hemispherical, 9-10 µm or about half of the anal body-width long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the male reproductive system. Odontostyle 8 µm long. Odontophore flanged, 8-9 µm long. Spicules 30-31 µm long along the curved median line. Lateral guiding pieces 5-6 µm long. In addition to the adanal pair, three ventromedian supplements present. Subventral papillae indistinct. Prerectum about 5.5 anal body-widths long. Tail rounded, slightly longer than female, 13-14 µm long, with two caudal pores on each side.

Habitat and locality: From soil around roots of citrus near Kwezing, South Sikkim.

Remarks: The present population fits well with the original description of I. variabilis provided by Jairajpuri and Loof (1966). However, it slightly differs in having shorter body (L = 1.1 mm in the type population).

GENUS BASIROTYLEPTUS JAIRAJPURI, 1964

Basirotyleptus caudatus Jairajpuri, 1966

(Fig. 26, D-F)

Basirotyleptus caudatus Jairajpuri, 1966, Proc. Helminth. Wash. Soc., 33: 30-33.

Measurements:

Females (3): L = 0.40-0.42 mm; a = 21-24; b = 4.0-4.9; c = 23.5-30.0; V = 42-43[4-5].

Description:

Female: Body ventrally curved in its posterior half upon fixation. Cuticle distinctly striated, 1-5 µm thick (thickest on tail tip). Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region off set by a constriction, wider than adjoining body, about 1/2.7 of body-width at base of oesophagus. Amphids cup-shaped, their apertures 3 µm wide and 3 µm from anterior end of body. Odontostyle typical to the genus, 11-13 µm long. Stoma sclerotized, 8-9 µm long. Odontophore 8-9 µm long. Basal oesophageal bulb pyriform, about one corresponding body-width long. Nerve ring 57-61 µm from anterior end. Cardia rounded. Prerectum 28-34 µm or about 2.3-3.0 anal body-widths long. Rectum 12-13 µm or about one anal body-width long. Vulva transverse. Vagina thick walled, 8-9 µm or about half of the corresponding body-width long. Female reproductive system mono-opisthodelphic. Anterior uterine sac 4-5 µm.

Tail conoid, with rounded tip, 14-17 µm or 1.2-1.4 anal body-width long.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Tarku, South Sikkim.

Basirotylenchus pini Siddiqi & Khan, 1965

(Fig. 26, G-I)

Basirotylenchus pini Siddiqi & Khan, 1965; Proc. Helminth. Soc. Wash., 32: 23-31.

Measurements:

Females (10): L = 0.47-0.54 mm (0.50); a = 24-32 (26);
b = 4.4-5.0 (4.6); c = 50-60 (55);
V = 32-38(46)$^{14-19(17.5)}$.

Description:

Female: Body ventrally curved in its posterior half upon fixation. Cuticle striated, 1.5-4.0 µm thick (thickest on tail tip). Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region off set by a constriction, about 1/2 of body width at base of oesophagus. Amphids cup-shaped 4.0-4.5 µm wide and 3.0-3.5 µm from anterior end. Odontostyle typical to

the genus, 8-9 µm long. Stoma 7.5-8.5 µm long. Odontophore 12-14 µm long. Basal oesophageal bulb pyriform, about one corresponding body-width long. Nerve ring 58-63 µm from anterior end of body. Cardia rounded. Prerectum 38-42 µm or 2.7-3.2 anal body-width long. Rectum 12-14 µm or about one anal body-width long. Vulva transverse. Vagina thick walled, 8-9 µm or slightly less than 1/2 of the corresponding body-width long. Female reproductive system mono-opisthodelphic. Anterior uterine sac 6-10 µm long.

Tail hemispherical, 8-9 µm or 0.6-0.7 anal body-width long.

Male: Not found.

Habitat and locality: From soil around roots of citrus at Rablong, South Sikkim.

FAMILY DORYLAIMOIDIDAE SIDDIQI, 1969

GENUS DORYLAIMOIDES THORNE & SWANGER, 1936

Dorylaimoides micoletzkyi (de Man,1921) Thorne & Swanger, 1936

(Fig. 27, A-C)

Dorylaimus micoletzkyi de Man, 1921, Capita Zool., 1: 3-62.
Dorylaimoides micoletzkyi (de Man, 1921) Thorne & Swanger, 1936, Capita Zool., 6: 22-34.
Dorylaimoides pakistanensis Siddiqi, 1964, Nematologica, 9: 626-634.

Measurements:

Females(9): L = 1.06-1.63 mm (1.34); a = 30-38 (34);
b = 5.1-6.6 (5.6); c = 15-18 (16.2);
V = $^{12\text{-}14(12.5)}_{44\text{-}46(45.2)}{}^{11.6\text{-}17.0(13.7)}$.

Male (1): L = 1.20 mm; a = 43; b = 6.0; c = 22; T = 49.

Description:

Female: Body slightly ventrally curved or open 'C' shaped when fixed, tapering gradually towards both ends. Cuticle finely striated, 2-6 µm thick (thickest on tail). Lateral hypodermal chords 1/12th-1/10th of body-width near middle.

Lip region off set by a slight depression. Amphids stirrup-shaped; apertures 5.0-5.5 µm wide and 4.5-5.0 µm from anterior end of body. Odontostyle measures 9-10 µm ventrally and 11-14 µm dorsally. Guiding ring 7-8 µm from anterior extremity. Odontophore curved, 16-19 µm long. Basal expanded part of oesophagus occupying 23-25% of the neck region. Cardia rounded. Nerve ring at 90-127 µm from anterior end. Prerectum 110-185 µm or 5.5-7.0 anal body-widths long. Rectum 21-25 µm long. Vulva a transverse slit. Vagina 15-21 µm long, moderately sclerotized distally. Female reproductive system amphidelphic. Oviduct and uterus separated by sphincter. Ovaries reflexed.

Tail elongate conoid, terminus bent dorsally, 70-105 µm or 3.5-4.0 anal body-widths long, with 2-3 caudal pores on each side.

Male: Similar to female in general shape and morphology except the male genital system. Spicules 35 µm long along the curved median line. Lateral guiding pieces 7 µm long. In addition to the adanal pairs, 5 ventromedian supplements present, irregularly spaced. The first ventromedian supplement within the range of spicules. Tail elongate-conoid, 54 µm or 2.8 anal body-widths long.

Habitat and locality: Several females and one male were collected from soil around roots of citrus at Tadung, Khumdong Basti and Sang in East Sikkim. Few females were also collected from Rablong, South Sikkim, and Yangthang Tikjik in West Sikkim.

Dorylaimoides longiurus Siddiqi, 1965

(Fig. 27, D-F)

Dorylaimoides longiurus Siddiqi, 1965, Proc. Helminth. Soc. Wash., 32: 81-90.

Measurements:

Females(2): L = 0.84-1.02 mm; a = 35-41; b = 4.1-5.7; c = 5.2-6.0; V = $^{0.8}28\text{-}34.5^{10\text{-}12}$.

Description:

Female: Body almost straight and tapering gradually towards both ends. Cuticle finely striated, 1.5-3.5 µm thick (thickest on tail). Lateral hypodermal chords 1/5th of body-width near middle.

Lip region marked off by a constriction, slightly wider than adjoining body. Amphids cup-shaped; their apertures 4-5 µm wide and 3.5 µm from anterior end of body. Odontostyle measures 6-7 µm ventrally and 9-10 µm dorsally; aperture 2.5 µm long. Guiding ring about 6 µm from anterior end. Odontophore curved, 14-16 µm long. Basal expanded part of oesophagus occupying about 30% of the neck region. Cardia rounded. Nerve ring at 77-79 µm from anterior end. Prerectum 68-75 µm or about 5-6 anal body-widths long. Rectums 16 µm or 1.3 anal body-width long. Vulva a transverse slit. Vagina 9 um long, sclerotized distally. Female reproductive system mono-opisthodelphic. Anterior uterine sac 6-9 µm or about 1/3rd of the corresponding body-width. Oviduct and uterus separated by sphincter.

Tail elongate, tapering gradually towards tail tip, rounded terminus, 138-172 µm or about 11-13 anal body-widths long, with two caudal pores on each side.

Male: Not found.

Habitat and locality: From the soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks: The present female specimen differs from the original description in having shorter anterior uterine sac 6-9 µm in Sikkim population against 24 µm or slightly less than one anal body-width long in the type population).

Dorylaimoides mujtabai sp. n.

(Fig. 28)

Measurements:

Kwezing population (type):

Holotype Female: L = 0.73 mm; a = 29; b = 5.0; c = 21.5; V = $^{12}_{44}{}^{11}$.

Paratype Females(8): L = 0.60-0.83 mm (0.75); a = 26-36; (29); b = 4.7-5.5 (5.0); c = 17.7-23.0 (20.6); V = $^{10\text{-}12.5(11.5)}_{40.2\text{-}46.6(44.2)}$ 9.2-13(11.6).

Paratype Male (1): L = 0.75 mm; a = 30; b = 5.1; c = 20.3; V = 52.

Yangthang population:

Female (1): L = 0.86 mm; a = 31; b = 5.1; c = 21.6;
V = $^{11}_{41}{}^{12}$.

Description:

Female: Body open 'C' shaped upon fixation, tapering slightly towards both ends. Cuticle finely striated, 1.5-4.0 µm thick (thickest at tail). Lateral hypodermal chords 1/7th-1/6th of body-width near middle. Dorsal, ventral and lateral body pores indistinct.

Lip region slightly marked by a slight constriction, 1/4th-1/3rd of body-width at base of oesophagus, lips bearing the usual number of papillae. Amphids stirrup-shaped; their apertures occupying 5.0-5.5 µm or 60-70% of the corresponding body-width, and 3.5-4.0 µm from anterior end of body. Sensillar pouches 12-14 µm from amphidial slits. Odontostyle 5.0-6.5 µm ventrally and 6-8 µm dorsally; its aperture 1.5-2.0 µm. Guiding ring 5.0-5.5 µm from anterior extremity. Odontophore typical to the genus, 15-16 µm long. Anterior slender part of oesophagus less muscular. Basal expanded part of oesophagus occupying 23-27% of the neck region. The locations of oesophageal gland nuclei and their orifices as follows: DO = 76.6-78.6; DN = 79-81.3; DO-DN = 1.9-2.7;

S_1N_1 = 84.6-86.0; S_1N_2 = 87.0-88.0; S_2N = 91.3-92.0; S_2O = 92.6-93.0; K = 78-85; K' = 65-75. Nerve ring 70-76 µm or 47-52% of neck region from anterior end. Cardia rounded, enveloped by intestinal tissue. Prerectum 74-87 µm or 3.5-5.8 anal body-widths long. Rectum 16-19 µm or about one anal body-width long.

Vulva a transverse slit. Vulva-vagina junction moderately sclerotized. Vagina extending 10-13 µm or 43-52% of the corresponding body-width. Female reproductive system amphidelphic. Uterus and oviduct separated by well developed sphincter. Ovaries reflexed; oocytes first arranged in a single row, then in double rows and multiple rows at the growth region.

Tail conoid, ventrally arcuate with a slight constriction ventrally in posterior third and rounded terminus, 34-41 um or 2.0-2.4 anal body-widths long; with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the male genital system. Odontostyle 5.5 µm ventrally. Odontophore 16 µm long. Spicules 25 µm long along the curved median line. Lateral guiding pieces obscure. In addition to the adanal pair, only two ventromedian supplements present. Subventral papillae could not be observed. Prerectum 85 µm or

4.7 anal body-widths long. Tail conoid, ventrally arcuate with rounded terminus, 34 µm or about two anal body-widths long; with two caudal pores on each side.

Type habitat and locality: From soil around roots of citrus at Kwezing, South Sikkim.

Yangthang population: From soil around roots of citrus at Yangthang, West Sikkim.

Differential diagnosis: Doryleimoides mujtabai sp. n. comes close to D. arcuicaudatus Baqri & Jairajpuri, 1969 in having amphidelphic reproductive system and arcuate conoid tail. However, it differs in having shorter body odontostyle and prerectum (L = 1.2 mm; odontostyle 7-10 µm ventrally and prerectum 110-117 µm long in D. arcuicaudatus). The male further differs in having shorter spicules and only two ventromedian supplements (spicules 37-40 µm and ventromedian supplements five in D. arcuicaudatus). Doryleimoides mujtabai sp. n. also comes close to D. loofi Baqri & Khera, 1979 but can be distinguished by shorter odontostyle; longer and ventrally arcuate tail; and male with only two ventromedian supplements (odontostyle 7-8 µm ventrally; tail conoid with bluntly rounded terminus, 23-25 µm or less than 1.5 anal body-width long; and male with four ventromedian supplements in D. loofi).

This new species has been named after my uncle, Syed Hasan Mujtaba Baqri, who not only acted as a guardian but also sponsored my education up to post graduate level.

SUBORDER DIPHTHEROPHORINA COOMANS & LOOF, 1970

SUPERFAMILY TRICHODOROIDEA THORNE, 1935

FAMILY TRICHODORIDAE THORNE, 1935

PARATRICHODORUS SIDDIQI, 1974

Paratrichodorus (Atlantodorus) porosus (Allen,1957)Siddiqi,1974

(Fig. 22, J-L)

Trichodorus porosus Allen, 1957, Nematologica, 2: 36-62.
Trichodorus bucrius Lordello & Zanith, 1958, An. Acad. Brasil Cien., 30: 103-105.
Paratrichodorus porosus (Allen, 1957), Siddiqi, 1974, Nematologica, 19: 259-278.

Measurements:

Females (10): L = 0.50-0.66 mm (0.58); a = 14-19 (16);
b = 4.6-6.4 (5.1); c = subterminal;
V = $^{16-22(18)}_{54-57(57)}{}^{14-20(17)}$

Description:

Female: Body robust, almost straight upon fixation. Cuticle finely striated, 3-9 µm thick. Two pairs of ventromedian pores present near vulva, one pair on each side of vulva.

Lip region marked by a slight constriction, about 1/4th of body-width at base of oesophagus. Amphids stirrup-shaped; their apertures 4-5 µm wide and 5-6 µm from anterior extremity. Onchio-style typical to the genus, 51-56 µm long; its anterior tip 22.27 µm long. Guiding ring 22-24 µm from anterior end. Basal expanded part of oesophagus pyriform. Intestine slightly overlapping the posterior oesophagus. Vulva a transverse slit. Vagina 5.0-7.5 µm long with two sclerotized pieces at distal end. Female reproductive system amphidelphic. Anus sub-terminal.

Male: Not found.

Habitat and localities: From soil around roots of citrus at Sang, Bong Khumdang Basti, Sajung, and Tadung in East Sikkim; Gyalshing, Guruthang, Langang Basti, Yangthang Tik Juk, Raythang, Kabirthang and Geyzing West in West Sikkim; Tekgehri, Turung, Mangro Basti and Kwezing in South Sikkim.

Remarks: This is a widely distributed and important pest of citrus in Sikkim. In some of the samples, its dominance was also significant.

ORDER MONONCHIDA JAIRAJPURI, 1969

SUBORDER MONONCHINA KIRJANOVA & KRALL, 1969

SUPERFAMILY MONONCHOIDEA CHITWOOD, 1937 (CLARK, 1961)

FAMILY MONONCHIDAE CHITWOOD, 1937

GENUS MONONCHUS BASTIAN, 1865

Mononchus truncatus Bastian, 1865

(Fig. 29, A-D)

Mononchus truncatus Bastian, 1865, Tr. Linn. Soc. London, 25: 73-184.

Mononchus macrostoma Bastian, 1865, Tr. Linn. Soc. London, 25: 73-184.

Mononchus (Mononchus) obtusus Cobb, 1917, Soil Sciences, 3: 431-486.

Mononchus longicaudatus Cobb, 1893, Macleay Mem. Vol. Linn. Soc. N. South Wales, 252-308.

Mononchus (Mononchus) allgeni Meyl, 1957, Inst. Roy. sci. Nat. Belg., 3: 27-51.

Measurements:

Females (2): L = 1.95-2.02 mm; a = 32-38; b = 3.4-3.7; c = 7.4-8.0; V = $^{10.0-11.5}_{54-59}{}^{11-12}$.

Description:

Female: Body slightly ventrally curved upon fixation. Cuticle smooth, 3-6 µm thick at various places of the body. Lip region slightly wider than adjoining body, 28-30 µm wide and 18-20 µm high. Amphids stirrup-shaped; apertures about 5 µm

wide, situated above the level of the dorsal tooth. Buccal cavity 50-51 x 20-23 µm. Apex of the dorsal tooth 40 µm from base of the stoma. Nerve ring 152-154 µm from anterior end. Oesophago-intestinal junction non-tuberculate. Vulva a transverse slit. Vagina thick walled. Female reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Ovaries reflexed. Tail tapering gradually to become cylindrical in the posterior two thirds, 245-273 µm or 7-9 anal body-widths long; tip rounded. Three caudal glands present; spinneret terminal.

Habitat and locality: Soil around roots of citrus and unidentified grasses at Bojo Ghari, 6 km from Gangtok, East Sikkim.

Remark : This species has been recorded for the first time from India.

GENUS CLARKUS JAIRAJPURI, 1970

Clarkus elongatus Jairajpuri & Khan, 1977

(Fig. 29, E-F)

Clarkus elongatus Jairajpuri & Khan, 1977, Nematologica, 23: 89-96.

Measurements:

Female (3): L = 2.30-2.50 mm; a = 30-50; b = 3.9-4.8; c = 10.4-19.0; V = $^{14-15.4}_{58-61}{}^{13-14}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle smooth, 5-10 µm thick. Lip region 37-40 µm wide and 12-18 µm high, wider than adjoining body. Amphids cup-shaped; their apertures 4 µm wide, at the level of dorsal tooth apex. Buccal cavity 40-42 x 20-22 µm. Apex of dorsal tooth 30-32 µm or 75% from base of stoma. Subventral walls with non-denticulate ridge. Nerve ring 135-150 µm from anterior end of body. Vagina sclerotized distally. Female reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Egg 90 x 70 µm. Tail elongate conoid, ventrally arcuate, 125-130 µm or 3 anal body-widths long. Caudal glands and spinneret absent.

Habitat and locality: Soil around roots of citrus at West Geyzing, West Sikkim.

GENUS PRIONCHULUS (COBB, 1916) WU & HOEPPLI, 1929

Prionchulus muscorum (Dujardin,1845) Wu & Hoeppli, 1929

(Fig. 29, G-H)

Oncholeimus muscorum Dujardin, 1845, Histoire naturelle des helminthes ou vers intetinaux: 654 pp.

Mononchus muscorum (Dujardin, 1845) Bastian, 1865, Tr. Linn. Soc. London, 25: 73-184.

Prionchulus muscorum (Dujardin, 1845) Wu & Hoeppli, 1929, Beihelt (1) Arch. Schiffs-u. Tropen Hyg., 33: 35-43.

Mononchus (Prionchulus) longicollis Cobb, 1917, Soil Science, 3: 431-486.

Mononchus (Prionchulus) punctatus Cobb, 1917, Soil Sciences, 3: 431-486.

Mononchus bastiani de Man, 1876, Tijdschr. Ned. Dierk. Ver, 2: 78-196.

Mononchus ctenodentatus Tysowski, 1915, Rozpr. i. Wiadom. Muz. Dziedusz., 1: 65-92.

Measurements:

Female (1): L = 1.81 mm; a = 29; b = 4.2; c = 18.8;
V = $^{14}_{67}{}^{12}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle smooth, 3.5-12 µm thick at different places of body. Lip region off set, wider then adjoining body, 27 µm wide and 14 µm high. Amphids cup-shaped, their apertures about 4 µm wide, at the level of dorsal tooth apex. Buccal cavity 33 x 18 µm. Apex of dorsal tooth 27 µm from base of buccal cavity. Denticulate ridge on ventral wall pronounced. Nerve ring 128 µm from anterior end. Female reproductive system amphidelphic. Sclerotized pieces present at vulva-vagina junction. Uterus and oviduct seprated by sphincter. Tail ventrally arcuate conoid, 96 µm or about 3 anal body-widths long.

Habitat and locality: From soil around roots of citrus near Gangtok, East Sikkim.

FAMILY MYLONCHULIDAE JAIRAJPURI, 1969

GENUS MYLONCHULUS (COBB, 1916) ALTHERR, 1954

Mylonchulus brachyuris (Butschli, 1873) Altherr, 1954

(Fig. 30, A-B)

Mononchus brachyuris Butschli, 1873: Nova Acta Acad. Nat. Curios, 36: 1-124.

Mononchus (Mylonchulus) brachyuris (Butschli, 1873) Cobb, 1917, Soil Science, 3: 431-486.

Mylonchulus brachyuris (Butschli, 1873) Altherr, 1954, Bull. Soc. Vandoise Sc. Nat. (287), 66: 33-46.

Measurements:

Females (7): L = 0.78-0.89 mm; a = 19-25; b = 3.2-3.4; c = 30-38; V = $^{6.7-7.0}_{59\ 62}{}^{9-10}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle smooth, 1.5-3.0 µm. Lip region off set from body by a constriction, wider than adjoining body, 20-22 µm wide and 7-8 µm high. Amphids cup-shaped, apertures about 4 µm wide. Buccal cavity 18-21 x 14-16 µm. Apex of dorsal tooth 14-16 µm from the base of stoma. Transverse rows of denticles 5. Submedian tooth present. Nerve

ring 80-88 µm from anterior end. Female reproductive system amphidelphic. Cuticularized pieces present at vulva-vagina junction. Uterus and oviduct not separated by sphincter. Tail conoid, ventrally arcuate, 22-26 µm long, with blunt terminus. Caudal glands distinct, spinneret sub-dorsal.

Habitat and locality: Soil around roots of citrus at Duga, East Sikkim.

Mylonchulus hawaiiensis (Cassidy, 1931) Andrássy, 1958

(Fig. 30, C-D)

Mononchus hawaiiensis Cassidy, 1931, Hawaiian Planters' Rec., 35: 305-339.

Mylonchulus hawaiiensis (Cassidy, 1931) Andrassy, 1958, Ann. Hist. Nat. Mus. Nat. Hungar., 50 (n.s. 9): 151-171.

Measurements:

Females(7): L = 0.80-0.97 mm; a = 20-26; b = 2.9-3.8; c = 24.0-38.4; V = $^{7.1-9.1}_{55-57}$ $^{7.0-7.5}$.

Description:

Female: Body ventrally curved upon fixation, more curved posterior to vulva. Cuticle 2-3 µm thick. Lip region marked by a slight constriction, wider than adjoining body, 20-21 x 9-10 µm. Amphids 4 µm wide. Buccal cavity 20-25 x 12-15 µm.

Apex of dorsal tooth 17-19 µm from base of buccal cavity. Transverse rows of denticles six. Submedian tooth present. Female reproductive system amphidelphic. Vagina sclerotized distally. Tail 25-38 µm or 1.3-1.6 anal body-width long. Caudal glands in tandem spinneret terminal.

Habitat and locality: From soil around roots of citrus at Gyalshing, South Sikkim.

Mylonchulus contractus Jairajpuri, 1970

(Fig. 30, E-G)

Mylonchulus contractus Jairajpuri, 1970, Nematologica, 16: 434-456.

Measurements:

Females (4): L = 0.67-0.74 mm; a = 20-25; b = 2.7-3.0; c = 26-30; V = $^{5.3-7.0}_{57-67}$ $^{6.0-7.6}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle 1-2 µm thick (thickest on tail). Lateral hypodermal chords about 1/5th of body-width near middle. Lip region wider than adjoining body. Amphids stirrup-shaped; apertures 5 µm wide and 7 µm from

anterior end. Buccal cavity 17-19.0 x 10-11 µm. Apex of dorsal tooth 13-14 µm from the base of buccal cavity. Reproductive system amphidelphic, typically small and pushing the intestine to the dorsal side. Cuticularized pieces present at vulva-vagina junction. Tail conoid, 23-29 µm long, slightly bent ventrally near middle, with rounded terminus. Caudal glands grouped, spinneret sub-terminal.

Habitat and localities: From soil around roots of citrus at Chong Shah, 6 km. from Gyalshing, West Sikkim; and Bong Khumdong Basti, East Sikkim.

Remarks: These specimens fit well with the original description provided by Jairajpuri (1970) except in having slightly longer tail (tail about one anal body-width long).

Mylonchulus amurus Khan & Jairajpuri, 1979

(Fig. 30, H-I)

Mylonchulus amurus Khan & Jairajpuri, 1979, Nematologica, 23: 89-96.

Measurements:

Females (5): L = 0.93-1.00 mm; a = 22-26; b = 3.0-3.2; c = 27-33; V = $^{7-9}57-64^{7.0-7.2}$.

Description:

Female: Body ventrally curved, open 'C' shaped upon fixation. Cuticle 1.5-3.0 µm thick. Lip region 23-25 um wide and 9-10 µm high, wider than adjoining body. Amphids stirrup-shaped, 4.0-4.5 µm wide. Buccal cavity 23-27 x 14-17 µm. Apex of dorsal tooth 18-20 µm from base of buccal cavity. Subventral wall bearing 5 transverse rows of denticles. Submedian teeth absent. Nerve ring 92-96 µm from anterior end. Female reproductive system amphidelphic. Sclerotized pieces present at vulva-vagina junction. Uterus and oviduct separated by a sphincter. Tail conoid with slight clavate terminus, 31-35 µm long. Caudal glands grouped. Spinneret terminal.

Habitat and locality: Soil around roots of citrus at Nalam, South Sikkim.

GENUS PARAMYLONCHULUS JAIRAJPURI & KHAN, 1982

Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan, 1982

(Fig. 31 A-S)

Mononchus index Cobb, 1906, Bull (5) Hawaiin Sugar Planters' Ass. Exper. Station, Div. Path. Physiol. 2nd ed.: 163-195.

Mylonchulus index (Cobb, 1906) Andrassy, 1958, Ann. Hist. Nat. Mus. Nat. Hungar. 50 (n.s.p): 151-171.

Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan, 1982, Associated Publ. Comp. 129 pp.

Measurements:

Females (3): L = 0.72-0.80 mm; a = 26-30; b = 2.6-3.0; c = 21-28; V = $\frac{11-12}{68-73}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle 1.5-2.5 µm thick (thickest on tail). Lateral hypodermal chords about 1/3rd of body-width near middle. Lip region slightly wider than adjoining body, 17 µm wide and 7.5 µm high. Buccal cavity 17-19 x 9-11 µm. Apex of dorsal tooth 14-15 µm from base of stoma. Denticles arranged in five transverse rows (4 complete and one incomplete row). Nerve ring 82-86 µm from anterior end. Rectum 12-15 µm long. Female reproductive system mono-prodelphic. Small cuticularized pieces present at vulva-vagina junction. Tail 30-36 µm or 1.4-1.8 anal body-width long, first hemispheroid then becomes a ventral finger-like projection with a rounded terminus. Caudal glands grouped. Spinneret terminal.

Habitat and locality: From soil around roots of citrus at Sajung, East Sikkim. Single female was also collected from Mangro Basti, South Sikkim.

Paramylonchulus mulveyi (Jairajpuri,1970)Jairajpuri & Khan,1982

(Fig. 31, C-D)

Mylonchulus mulveyi Jairajpuri, 1970, Nematologica, 16: 434-456.
Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982, Associated Publ. Comp., 129 pp.

Measurements:

Females (5): L = 0.80-1.00 mm; a = 29-38; b = 3.0-3.5; c = 20-25; V = 11.8-16.8 78-80.

Description:

Female: Body ventrally curved in posterior third of its length. Cuticle 1-1.5 µm thick. Lip region 16-19 µm wide and 8-9 µm high, wider than adjoining body. Amphids stirrup-shaped; apertures 4-5 µm wide. Buccal cavity 16-19 x 9-11 µm. Apex of the dorsal tooth 12-16 µm from base of buccal cavity. Subventral walls of the buccal cavity bearing 3-4 transverse rows of denticles. Submedian teeth absent. Nerve ring 76-85 µm from anterior end. Female reproductive system mono-prodelphic. Sclerotized pieces present at vulva-vagina junction. Oviduct and uterus separated by sphincter. Posterior uterine sac absent. Tail 38-43 µm long, markedly conoid, tapering sharply in posterior half, with a slight rounded tip. Caudal glands grouped. Spinneret terminal .

Habitat and localities: From soil around roots of citrus at Tekgehri, Tarku and Kwezing in South Sikkim; Geyzing west, Yangthang and Gyalshing in West Sikkim; Khumdong, Namli Gardens Tadung and Sang in East Sikkim.

SUPERFAMILY ANATONCHOIDEA JAIRAJPURI,1969(COOMANS & LOOF, 1970)

FAMILY IOTONCHIDAE JAIRAJPURI, 1969

GENUS IOTONCHUS (COBB,1916) ALTHERR, 1950

Iotonchus nayari Mohandas & Prabhoo, 1979

(Fig. 32, A-D)

Iotonchus nayari Mohandas & Prabhoo, 1979, Proc. Indian Acad. Sci., 88: 433-440.

Measurements:

Sang populations:

Females (2): L = 2.56-2.62 mm; a = 33-40; b = 4.3-4.6; c = 7.6-8.2; V = $^{11-15}_{61-67}{}^{10-16}$.

Males (2): L = 2.0-2.23 mm; a = 31-33; b = 3.8-4.2; c = 7.5-9.1; T = 48-50.

Gyalshing population:

Females (2): L = 1.95-2.02 mm; a = 32-38; c = 7.4-8.0; V = $^{10-12}_{56-60}{}^{11-12}$.

Males (2): L = 2.13-2.38 mm; a = 39-40; b = 4.7-5.0; c = 7.9-9.5; T = 30-36.

Description:

Female: Body ventrally curved in posterior half of its length. Cuticle smooth, 4-12 µm thick (thickest in tail). Lip region marked off by a constriction, 48-53 x 18-23 µm, wider than adjoining body. Amphids stirrup-shapped, 6-7 µm wide. Buccal cavity 53-60 x 39-48 µm. Apex of dorsal tooth 12-15 µm from base of buccal cavity. The oblique subventral walls of stoma bears 2 foramina each side. Nerve ring 160-166 µm from anterior end. Oesophago-intestinal junction tuberculate.

Vulva a transverse slit, ventral papillae not seen. Sclerotized pieces present at vulva-vagina junction. Female reproductive system amphidelphic. Uterus and oviduct separated by well developed sphincter. Egg 102-105 x 60-62 µm. Tail long, conoid then cylindrioid with broadly rounded terminus, 300-345 µm long. Caudal glands weak. Spinneret well developed; opening terminal but not very distinct.

Male: Buccal cavity 50-56 x 37-39 µm. Apex of dorsal tooth 10-16 µm from the base of buccal cavity. Spicules 118-134 µm long in Sang population while 103-110 µm in Gyalshing

population. Accessory pieces 15-16 µm. Gubernaculum 30-39 µm long. Supplements 12-15. Tail similar to female, 245-300 µm long. Caudal glands weak. Spinneret well developed, opening terminal but not distinct.

Habitat and localities: From soil around roots of citrus at Sang, East Sikkim; and at Gyalshing, West Sikkim.

Iotonchus indicus Jairajpuri, 1969

(Fig. 32, E-F)

Iotonchus indicus Jairajpuri, 1969, Nematologica, 15: 557-581.

Measurements:

Females (4): L = 1.89-2.15 mm; a = 33-39; b = 4.4-4.6; c = 4.8-5.0; V = $^{9.5-11.5}_{56-57}{}^{9-10}$.

Description:

Female: Body ventrally curved upon fixation. Cuticle 4-8 µm thick at various places of body. Lip region off set, wider than adjoining body, 37-45 µm wide and 15-16 µm high. Amphids small, cup-shaped; their apertures 5-6 µm wide. Buccal cavity 44-52 x 30-32 µm. Apex of dorsal tooth 11-12 µm from base of stoma. Nerve ring 130-150 µm from anterior end.

Oesophago-intestinal junction tuberculate. Vulva a transverse slit. Cuticularized pieces present at vulva-vagina junction. Reproductive system amphidelphic. Tail 392-425 µm or 9-11 anal body-widths long, elongate-conoid, tapering gradually. Caudal glands present, opening subterminal. Caudal papillae five.

Habitat and locality: From soil around roots of citrus at West Geyzing, West Sikkim.

Iotonchus longicaudatus Baqri, Baqri & Jairajpuri, 1978

(Fig. 32, G-I)

Iotonchus longicaudatus, Baqri, Baqri & Jairajpuri, 1978, Nematologica, 24: 436-444.

Measurements:

Female (1): L = 1.31 mm; a = 30; b = 4.0; c = 3.7; V = $^{0.9}_{60}$1.7

Description:

Female: Body ventrally curved upon fixation. Cuticle 2-11 µm thick (thickest on tail). Lip region off set by a constriction, wider than adjoining body, 25 µm wide and 12.5 µm high. Amphids stirrup-shaped, 5 µm wide. Buccal cavity 31 x 22 µm. Apex of dorsal tooth 7 µm or about 22% of the

buccal cavity from base. Nerve ring 106 µm from anterior end. Female reproductive system monoprodelphic. Small sclerotized pieces present at vulva-vagina junction. Uterus and oviduct separated by well developed sphincter. Sperms present in the uterus. Posterior uterine sac about 1/3rd of the corresponding body-width. Tail long filiform, 356 µm long or 26% of the body length. Caudal glands grouped. Spinneret subterminal.

Habitat and locality: From soil around roots of citrus at Seng, East Sikkim.

Remarks: Though the present specimen has been described as *I. longicaudatus*, but it differs in having dorsal tooth at the base of stoma whereas in *I. longicaudatus* the dorsal tooth is present in the anterior half of the stoma. Since only one female is available for the present study, it has been tentatively identified as *I. longicaudatus*.

GENUS *PARAHADRONCHUS* MULVEY, 1978

Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1978

(Fig. 31, E-H)

Hadronchus shakili Jairajpuri, 1969, *Nematologica*, 15: 557-581.
Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1982, *Can. J. Zool.*, 56: 1847-1868.

Measurements:

Females (10): L = 1.88-2.13 mm (2.01); a = 31-37 (35);
b = 4.1-4.7 (4.5); c = 4.5-7.0 (5.3);
V = $^{9-14(11.7)}_{56-58(57)}{}^{9-11(10.1)}$

Males (5): L = 1.84-2.10; a = 33-39 (37); b = 4.2-5.0 (4.7);
c = 5.0-7.0 (6.8); T = 34-38 (36).

Description:

Female: Body ventrally curved upon fixation. Cuticle 4.8 µm thick at various pieces of body. Lip region off set by a constriction, wider than adjoining body, 38-47 µm wide and 14-16 µm high. Amphids stirrup-shaped; their apertures 7-8 µm wide. Buccal cavity 43-50 x 29-36 µm. Apex of dorsal tooth 15-18 µm from base of buccal cavity. The vertical subventral wall bears 3-4 teeth and the oblique walls have two formmina on each side. Nerve ring 120-142 µm from anterior end. Oesophago-intestinal junction tuberculate. Vulva a transverse slit. Sclerotized pieces present at vulva-vagina junction. Reproductive system amphidelphic. Tail 402-475 µm or 11-13 anal body-widths long. Caudal glands well developed; spinneret terminal.

Male: Body more curved in posterior third of its length. Buccal cavity 32-46 x 27-30 µm. Apex of dorsal tooth 16-18 µm from base of buccal cavity. Spermatozoa spindle-shaped.

Spicules 76-86 µm medially. Gubernaculum 17-20 µm long. Accessory pieces 14-16 µm long. Supplements 11-12, regularly spaced. Tail 290 (tip broken) - 375 µm long. Caudal glands well developed; terminal opening.

Habitat and localities: From soil around roots of citrus at Sang and Khumdong Basti, East Sikkim; Ben and Mangro Basti, South Sikkim; Gyalshing and Yangthang, West Sikkim.

SUMMARY

During May 1981, random survey was conducted for the plant and soil inhabiting nematodes from around roots of citrus trees at the following three districts of Sikkim State: East, West and South. Over one hundred soil samples were collected from 28 localities. The present paper reports 61 species of the Orders Tylenchida, Aphelenchida, Dorylaimida and Mononchida, of which 10 are new to science.

The following 17 known and one new species of the Order Tylenchida, under 7 families and 13 genera, have been identified: Filenchus sp., Polenchus shamimi sp. n., Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959; Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971, Hoplolaimus indicus

Sher, 1963; Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958; Helicotylenchus dihystera (Cobb, 1893) Sher, 1961; Helicotylenchus exallus Sher, 1966; Helicotylenchus egyptiensis Tarjan, 1964; Rotylenchus sp.; Pratylenchus hexincisus Taylor & Jenkins, 1957; Pratylenchus loosi Loof, 1960; Pratylenchus scribneri Steiner, 1943; Meloidogyne sp., Nothotylenchus zygophylus Khan & Siddiqi, 1968; Criconemoides informis (Micoletzky, 1922) Taylor, 1936; Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957; Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957. Since Scutellonema brachyurum appeared to be an important pest of citrus in Sikkim, its allometric and morphometric variations have also been discussed. Aphelenchus avenae Bastian, 1865 belonging to the family Aphelenchidae of the Order Aphelenchida has been reported from many localities.

Twenty seven species belonging to 19 genera of 14 families under the order Dorylaimida have been reported. Out of 29 species, nine have been described as new. The short descriptions of the following known species have been provided: Oriverutus lobatus Siddiqi, 1971; Oriverutus sundarus (Williams, 1964) Siddiqi, 1971; Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983; Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1985; Neoactinolaimus agilis Thorne, 1967; Xiphinema insigne Loos, 1949; Xiphinema

brevicolle Lordello & Costa, 1961; Dorylaimellus indicus Siddiqi, 1964; Axonchium (Axonchium) phukani Rahman, Jairajpuri & Ahmad, 1985; Tylencholaimus pakistanensis Timm, 1964; Tylencholaimus obscurus Jairajpuri, 1965; Tylencholaimus micronanus Yeates, 1979; Discomyctus cephalatus Thorne, 1939; Proleptonchus clarus Timm, 1964; Tyleptus variabilis Jairajpuri & Loof, 1966; Basirotyleptus caudatus Jairajpuri, 1966; Basirotyleptus pini Siddiqi & Khan, 1965; Dorylaimoides micoletzkyi (de Man, 1921) Thorne & Swanger, 1936; Dorylaimoides longiurus Siddiqi, 1965; and Paratrichodorus (Atlantodorus) porosus (Allen, 1957) Siddiqi, 1974.

The following nine species of the order Dorylaimida have been described as new: Laimydorus minimus sp. n., Laimydorus coomansi sp. n., Labronemella hemicaudata sp. n., Oriverutus paranguiatus n. sp., Saevadorella intermoides sp. n., Sclerolabia salmae sp. n., Aporcelaimellus atheri sp. n., Dorylaimellus murtazai sp. n. and Dorylaimoides mujtabai sp. n.

The paper also reports the following thirteen known species belonging to three families of the order Mononchida: Mononchus truncatus Bastian, 1865; Clarkus elongatus Jairajpuri & Khan, 1977; Prionchulus muscorum (Dujardin, 1845) Wu & Hoeppli, 1929; Mylonchulus brachyuris (Bütschli, 1873) Altherr, 1954; Mylonchulus hawaiiensis (Cassidy, 1931) Andrassy, 1958;

Moylonchulus contractus Jairajpuri, 1969; Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan, 1982; Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982; Iotonchus indicus Jairajpuri, 1969; Iotonchus longicaudatus Baqri, Baqri and Jairajpuri, 1978; Iotonchus nayari Mohandas & Prabhoo, 1979; and Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1978. Mononchus truncatus has been recorded for the first time from India.

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Figures 1 - 32

Fig. 1

Filenchus sp.

A - Entire female,

B - Anterior region,

C - Posterior oesophageal region showing variations in the position of excretory pore,

D - Female reproductive system,

E - Female tail,

F - Male tail.

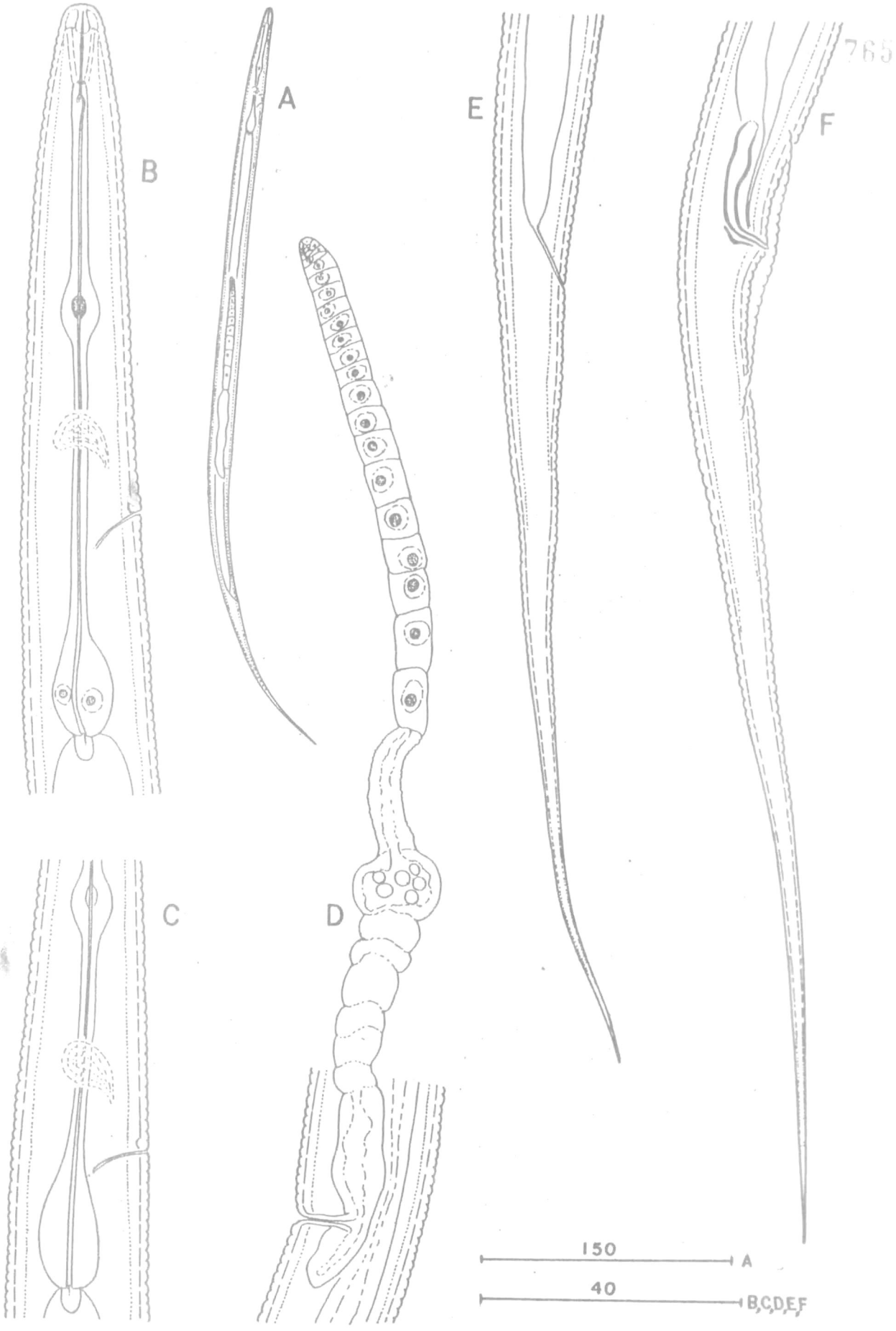

A
B
C
D
E
F
150
A
40
B,C,D,E,F

Fig. 2

Polenchus shamimi sp. n.

A - Anterior region,

B - Part of female reproductive system,

C - Female tail,

D - Male tail.

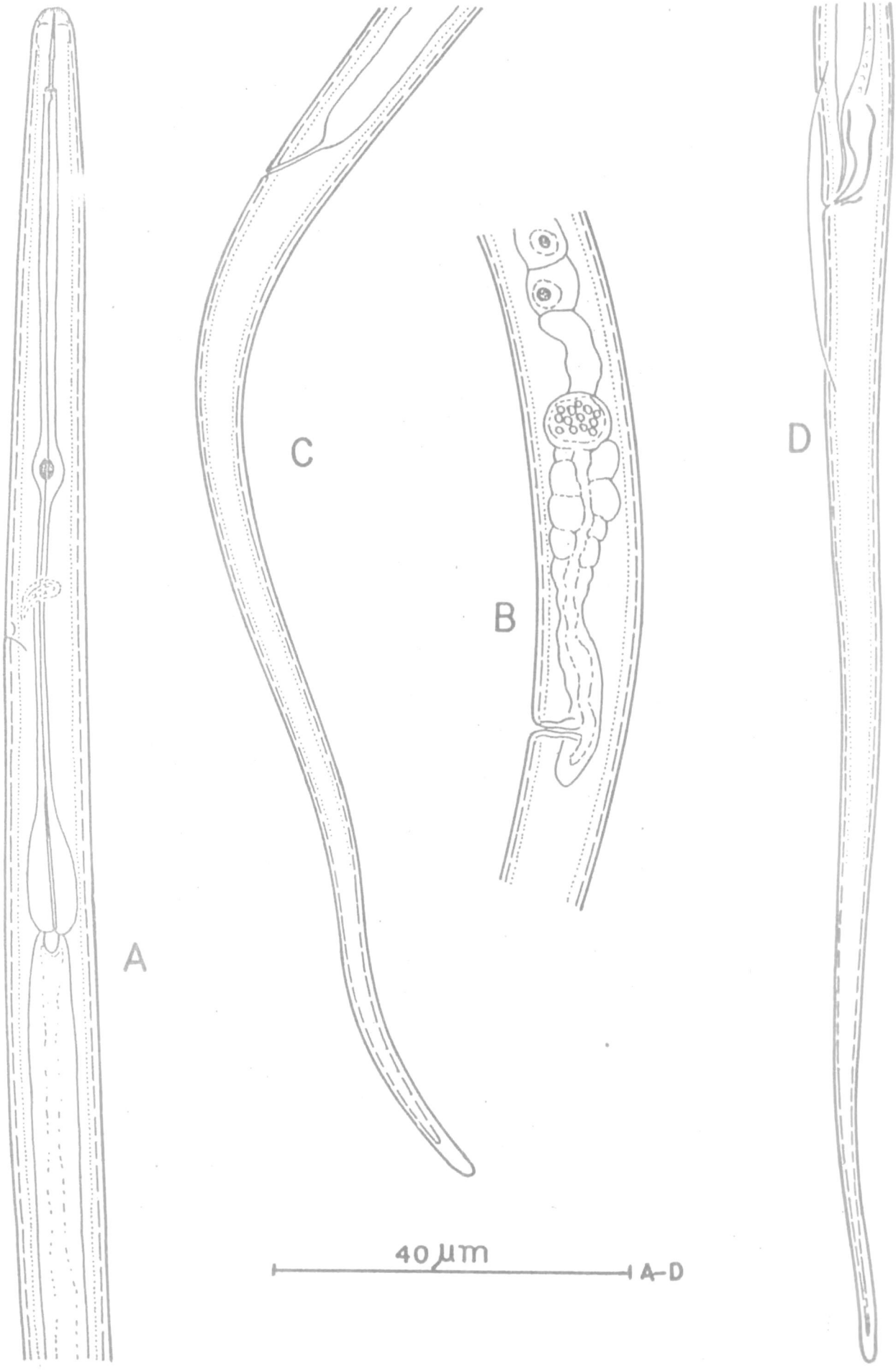

A
B
C
D
40 µm
A–D

Fig. 3

A - B: *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959

A - Anterior end,

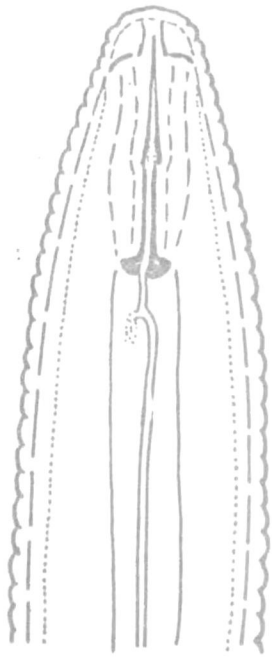
B - Female tail.

C - E: *Quinisulcius capitatus* (Allen, 1955) Siddiqi, 1971

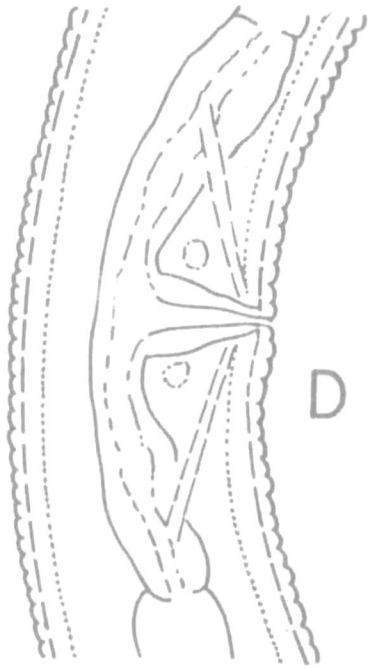
C - Anterior region,

D - Vulva region,

E - Female tail.



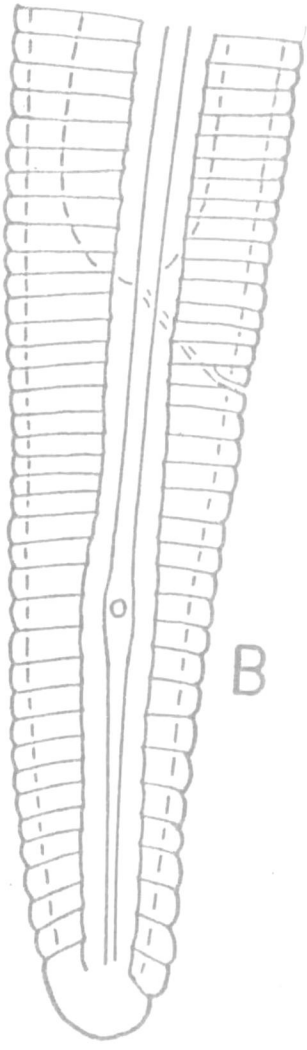
A



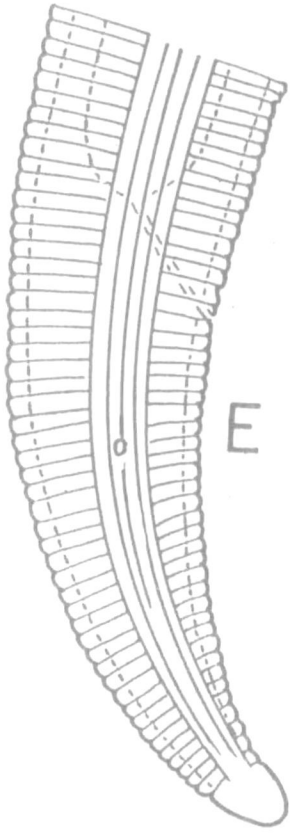
D

30µm A,B

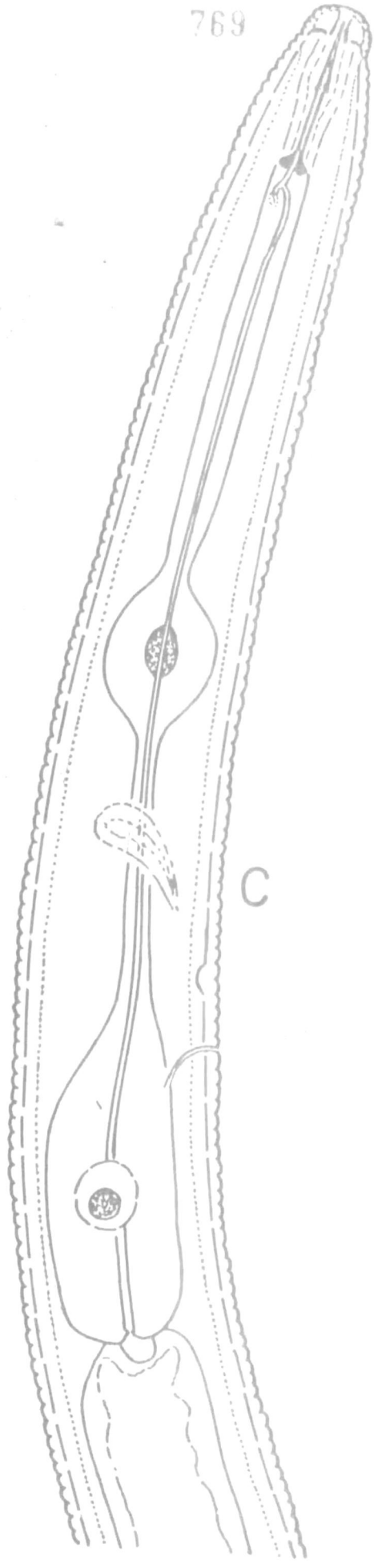
30µm C-E



B



E



C

Fig. 4

Hamiolaimus indicus Sher, 1963

A - Anterior end,

B - Posterior oesophageal region.

C - Surface view showing irregularly broken incisures,

D - Vulva, vagina and part of anterior sexual branch,

E - Female tail.

A
B
C
D
E
50µm
A-E

Fig. 5

Scutellonema brachyurum (Steiner, 1938) Andrassy, 1958

A - Entire female,

B - Anterior region,

C & D - Anterior ends showing variations in lip region shape,

E - Posterior oesophageal region showing variation in the position of excretory pore,

F - Female reproductive system.

G - Surface view at vulva region,

H-K - Female tail,

L - en face view;

M - T.S. at the level of basal annule of lip region.

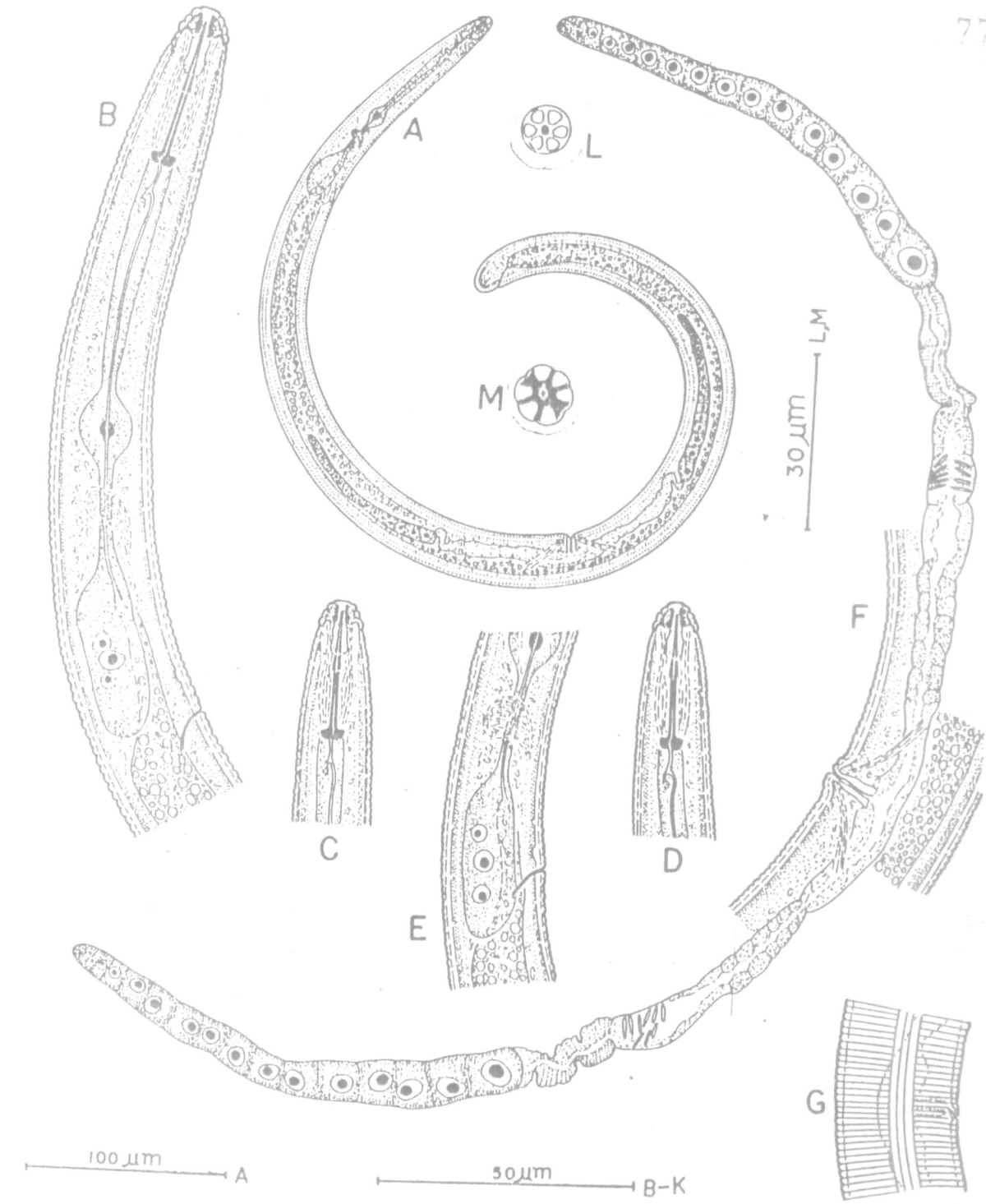
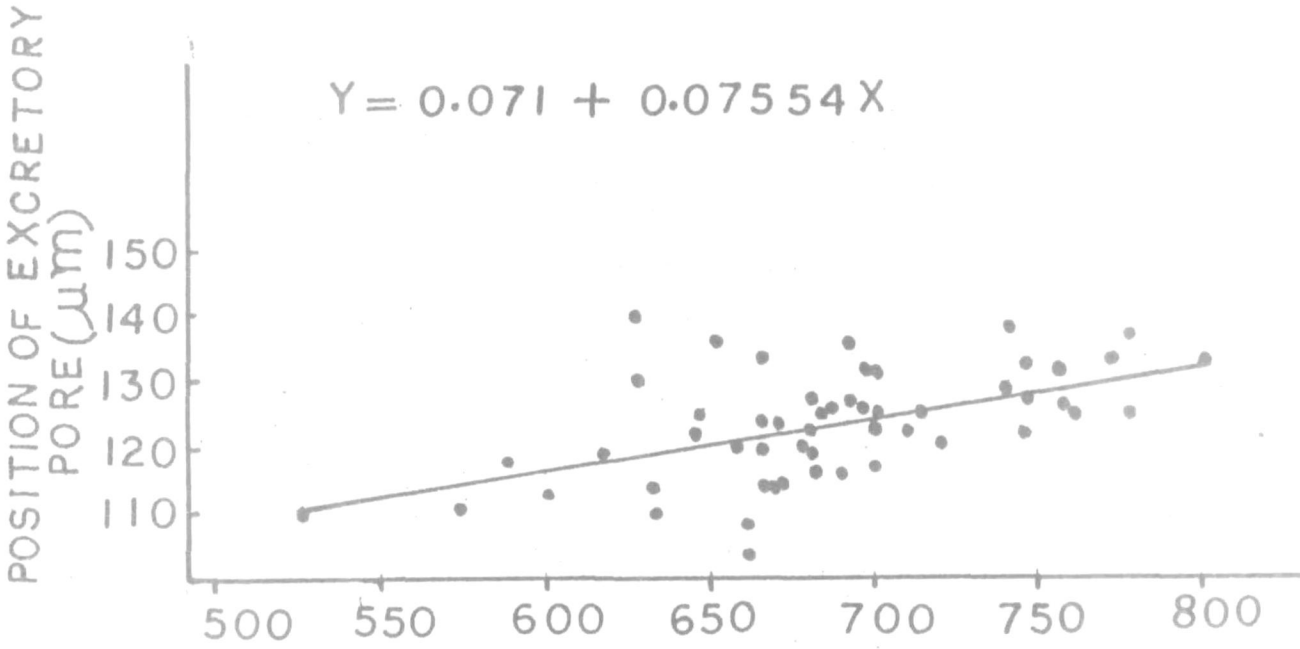

B
A
L
M
L.M.
30 µm
F
C
D
E
G
100 µm
A
50 µm
B-K
H
I
J
K

Fig. 6

Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958

Body length in relation to position of median oesophageal bulb and excretory pore.


Y = 0.071 + 0.07554 X
POSITION OF EXCRETORY PORE (µm)
150
140
130
120
110
500
550
600
650
700
750
800

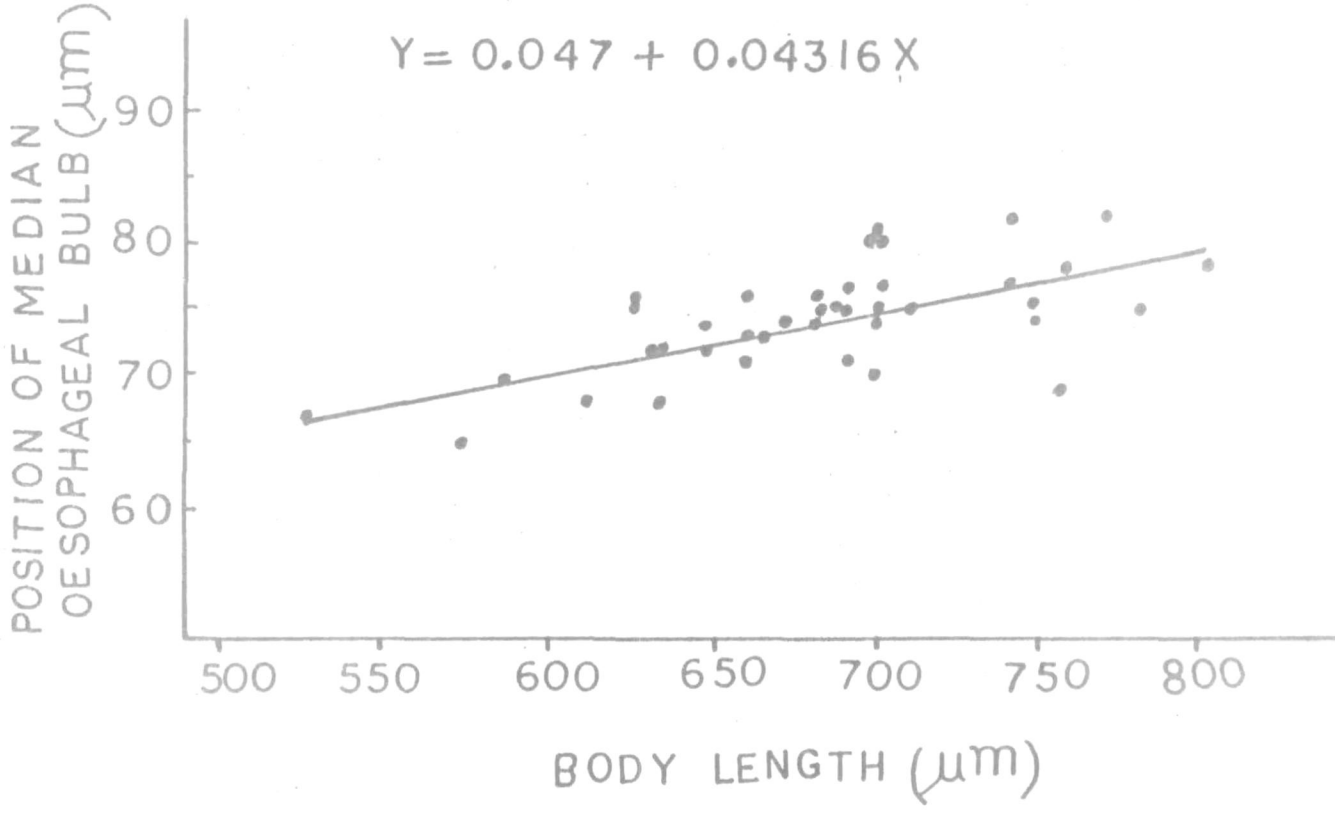

Y = 0.047 + 0.04316 X
POSITION OF MEDIAN OESOPHAGEAL BULB (µm)
90
80
70
60
500
550
600
650
700
750
800
BODY LENGTH (µm)

Fig. 7

Scutellonema brachyurum (Steiner, 1938) Andrássy, 1958

Body length in relation to length of stylet and position of vulva.

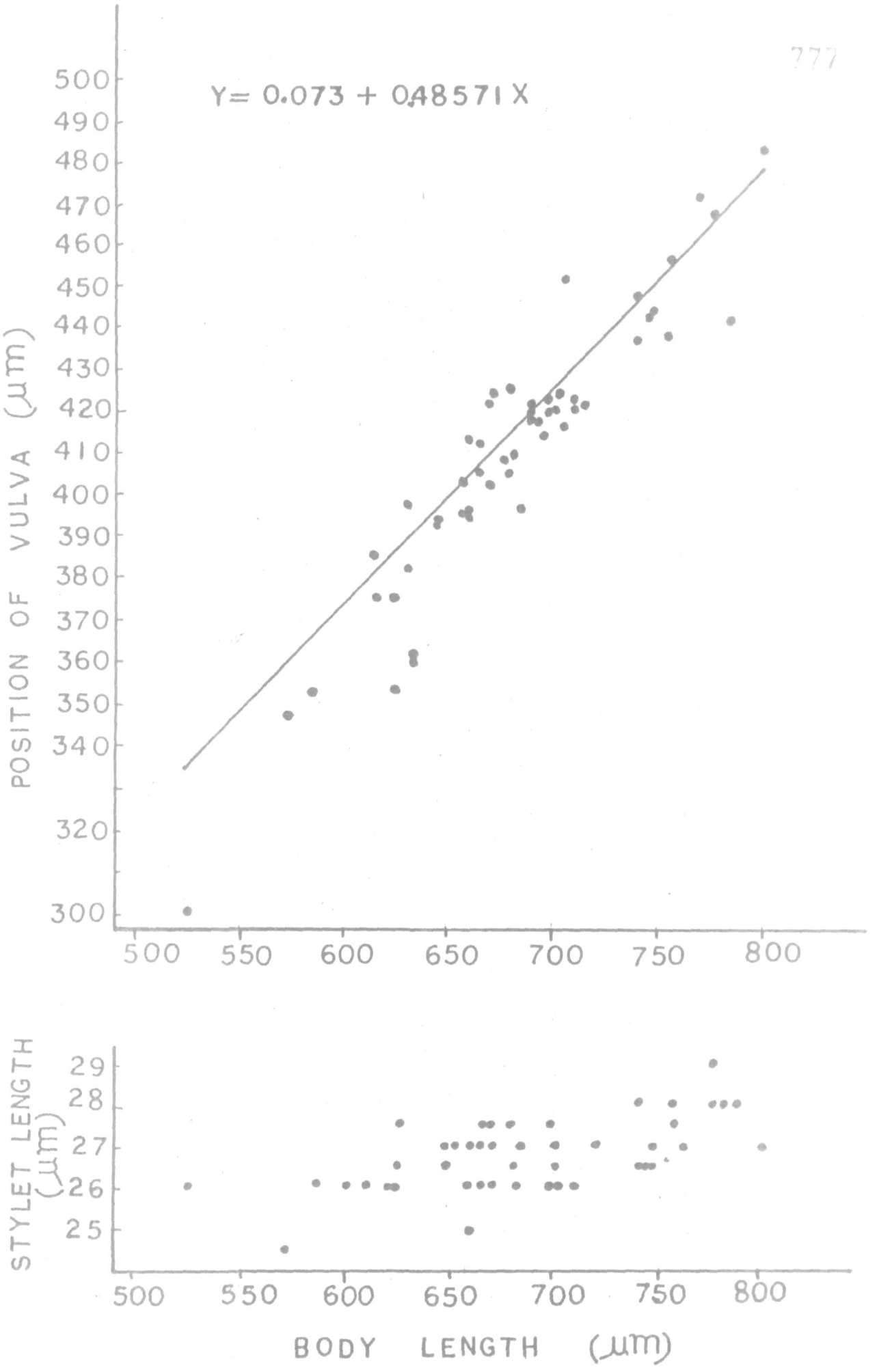

Y= 0.073 + 048571 X
POSITION OF VULVA (µm)
500
490
480
470
460
450
440
430
420
410
400
390
380
370
360
350
340
320
300
500 550 600 650 700 750 800
STYLET LENGTH (µm)
29
28
27
26
25
500 550 600 650 700 750 800
BODY LENGTH (µm)

Fig. 8

A - C: Helicotylenchus dihystera (Cobb, 1893) Sher, 1961

A - Anterior end,

B - Vulva, vagina and part of anterior sexual branch,

C - Female tail.

D - H: Helicotylenchus exallus Sher, 1966

D - Anterior end of female,

E - Vulva, vagina and part of anterior sexual branch,

F - Female tail,

G - Anterior end of male,

H - Male tail.

I - L: Helicotylenchus egyptiensis Tarjan, 1964

I - Anterior end,

J - Vulva, vagina and part of anterior sexual branch,

K - Tail (normal tip),

L - Showing variation in tail tip.

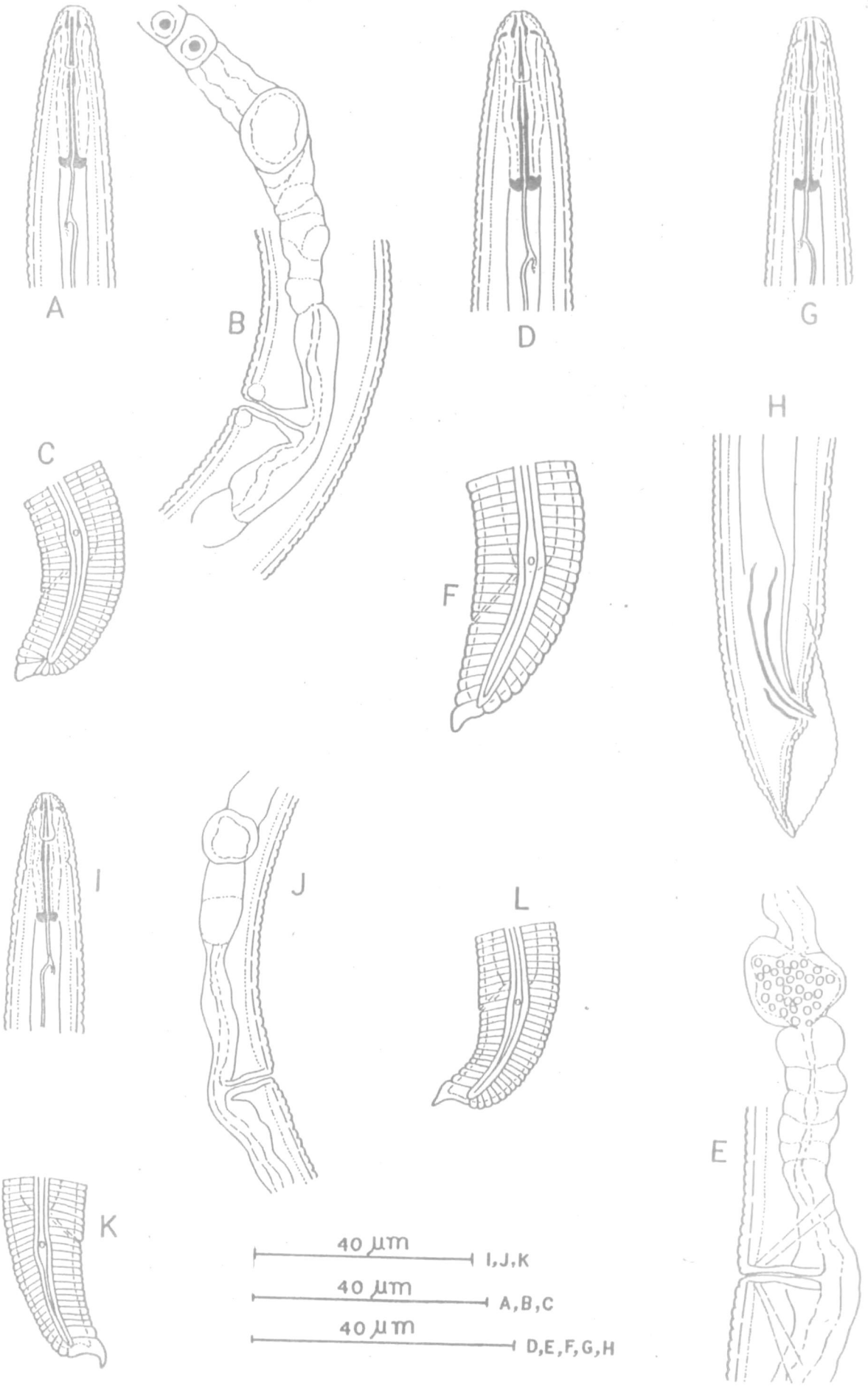

A
B
C
D
E
F
G
H
I
J
K
L
40 µm
I,J,K
40 µm
A,B,C
40 µm
D,E,F,G,H

Fig. 9

Rotylenchus sp.

A - Entire female,

B - Anterior region,

C - Anterior end,

D - Vulva, vagina and anterior sexual branch,

E & F - Female tails,

G - en face view,

H - T.S. at the level of basal annule of lip region.

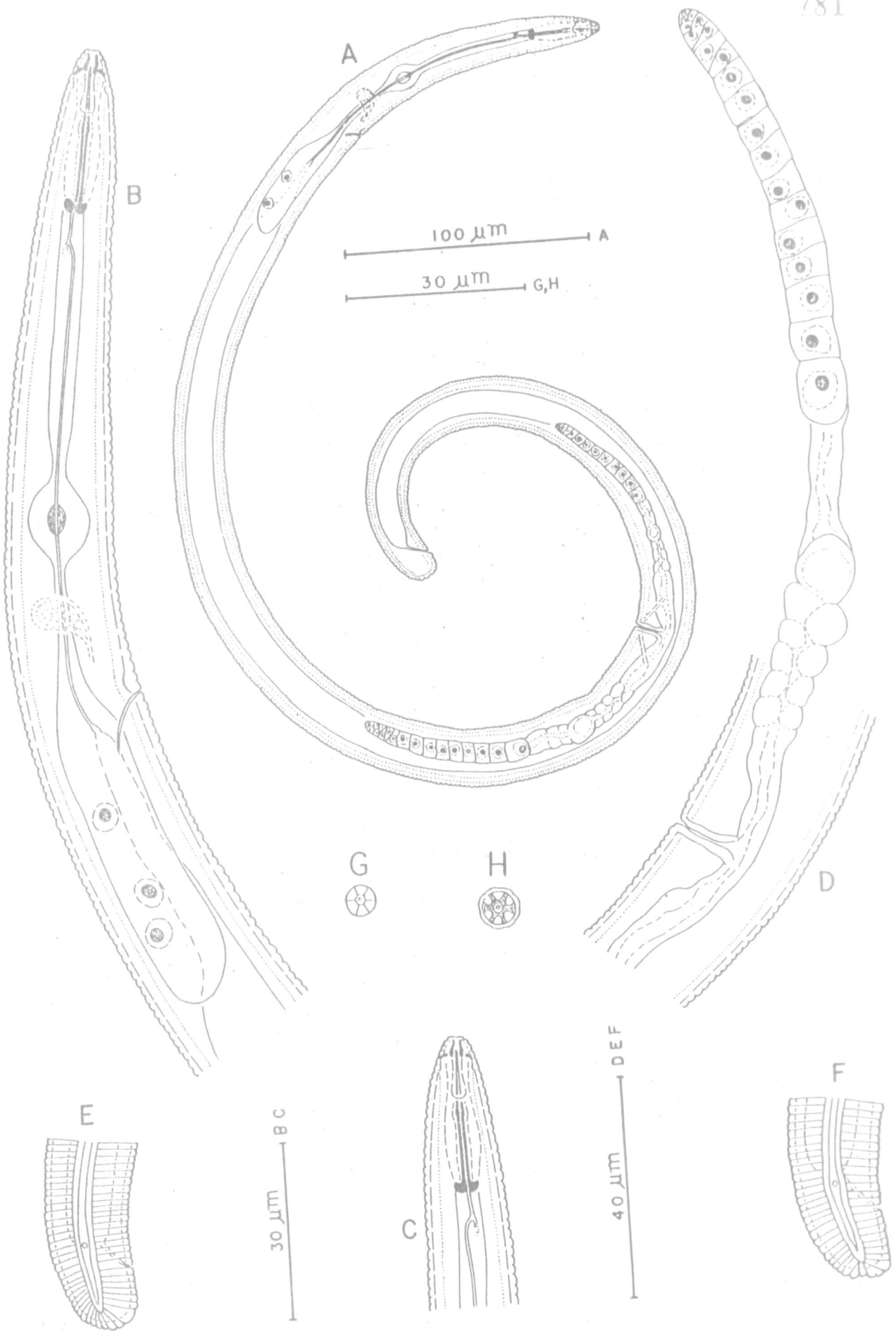

A
B
100 µm
A
30 µm
G,H
G
H
D
E
30 µm
B C
C
40 µm
D E F
F

Fig. 10

A - C: Pratylenchus hexincisus Taylor & Jenkins, 1957

A - Anterior region,

B - Surface view showing lateral fields,

C - Female tail.

D - F: Pratylenchus loosi Loof, 1960

D - Anterior region,

E - Posterior uterine sac and spermatheca in female reproductive system.

G - I: Pratylenchus scribneri Steiner, 1943

G - Anterior region,

H - Posterior uterine sac and spermatheca in female reproductive system,

I - Female tail.

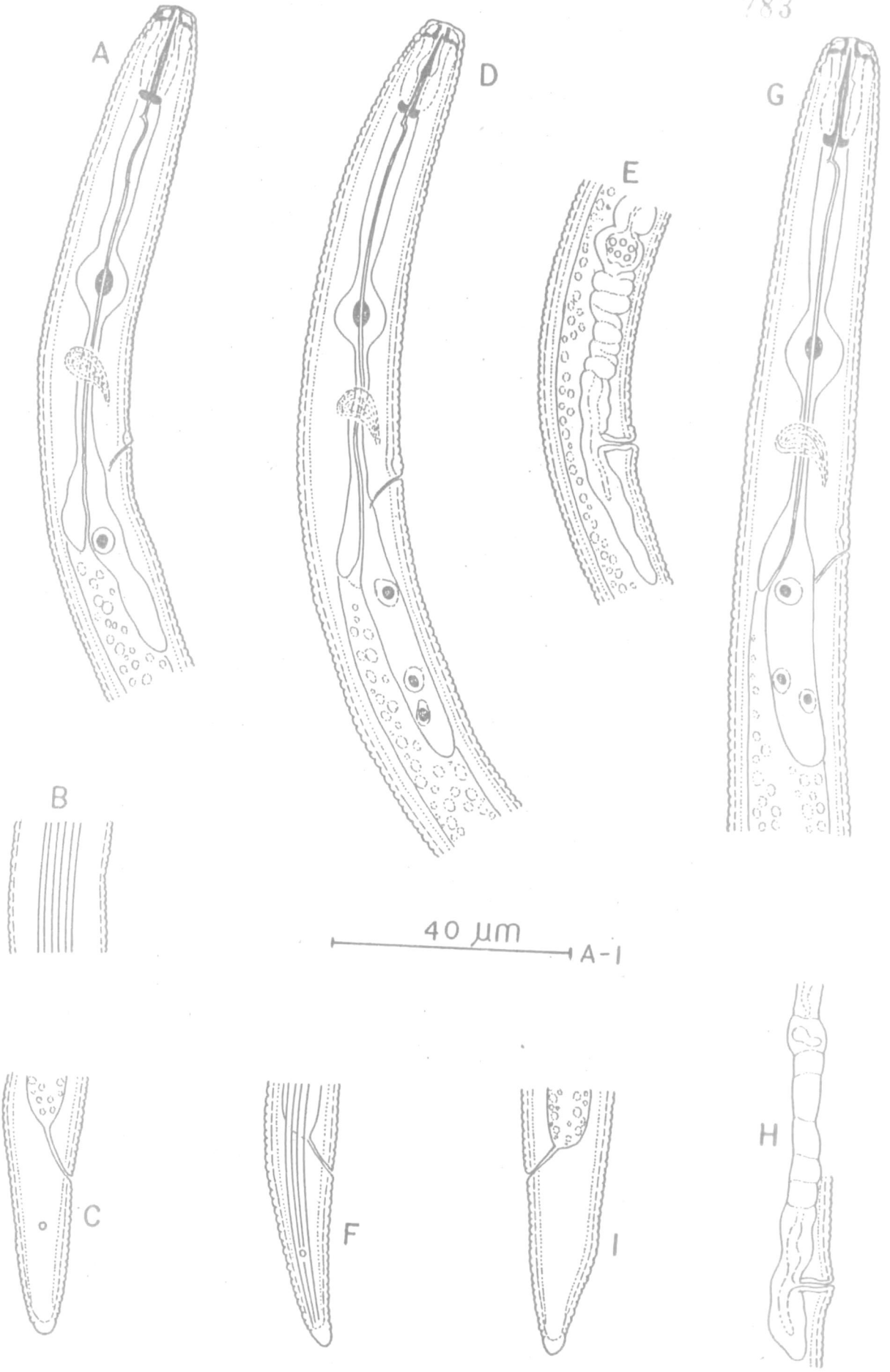

A
D
E
G
B
40 µm
A-I
C
F
I
H

Fig. 11

A - B: Hothotylenchus hexaglyphus Khan & Siddiqi, 1968

A - Anterior region,

B - Posterior region.

C - F: Aphelenchus avenae Bastian, 1865

C - Anterior region of female,

D - Female tail,

E - Anterior end of male,

F - Male tail.

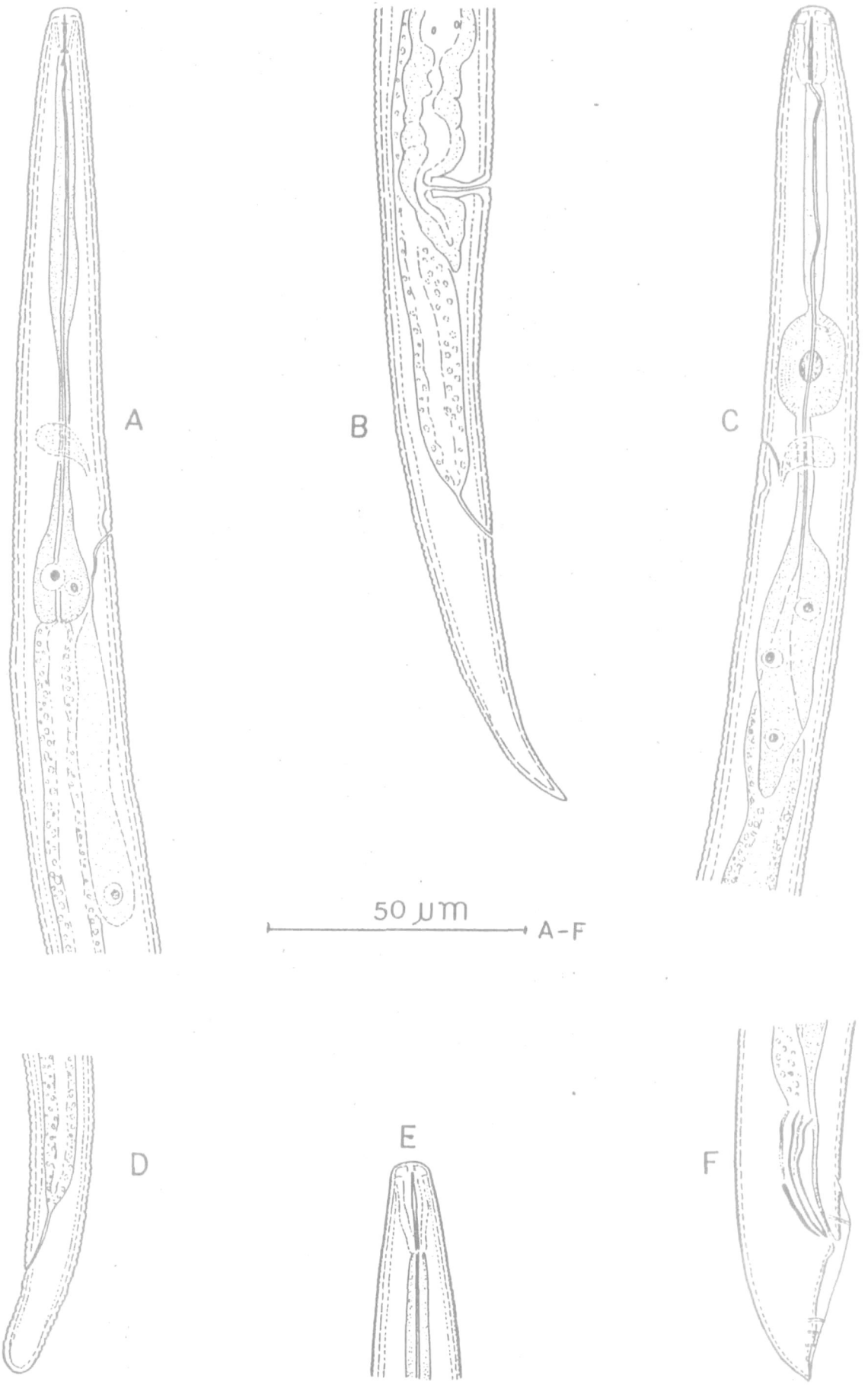

A
B
C
50 µm
A-F
D
E
F

Fig. 12

A - B: Criconemoides informis (Micoletzky, 1922) Taylor, 1936

A - Anterior region,

B - Posterior region.

C - E: Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957

C - Anterior region,

D - Posterior region,

E - Vulva and tail region,

F - G: Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957

F - Anterior region,

G - Posterior region.

A
B
C
D
E
F
G
50 µm
A,B
50 µm
C-E
50 µm
F,G

Fig. 13

Laimydorus minimus sp. n.

A - Entire female,

B - Anterior end,

C - Surface view of anterior end,

D - Basal expanded part of oesophagus and cardia,

E - Vulva, vagina and posterior sexual branch,

F - Female tail,

G - Female tail tip.

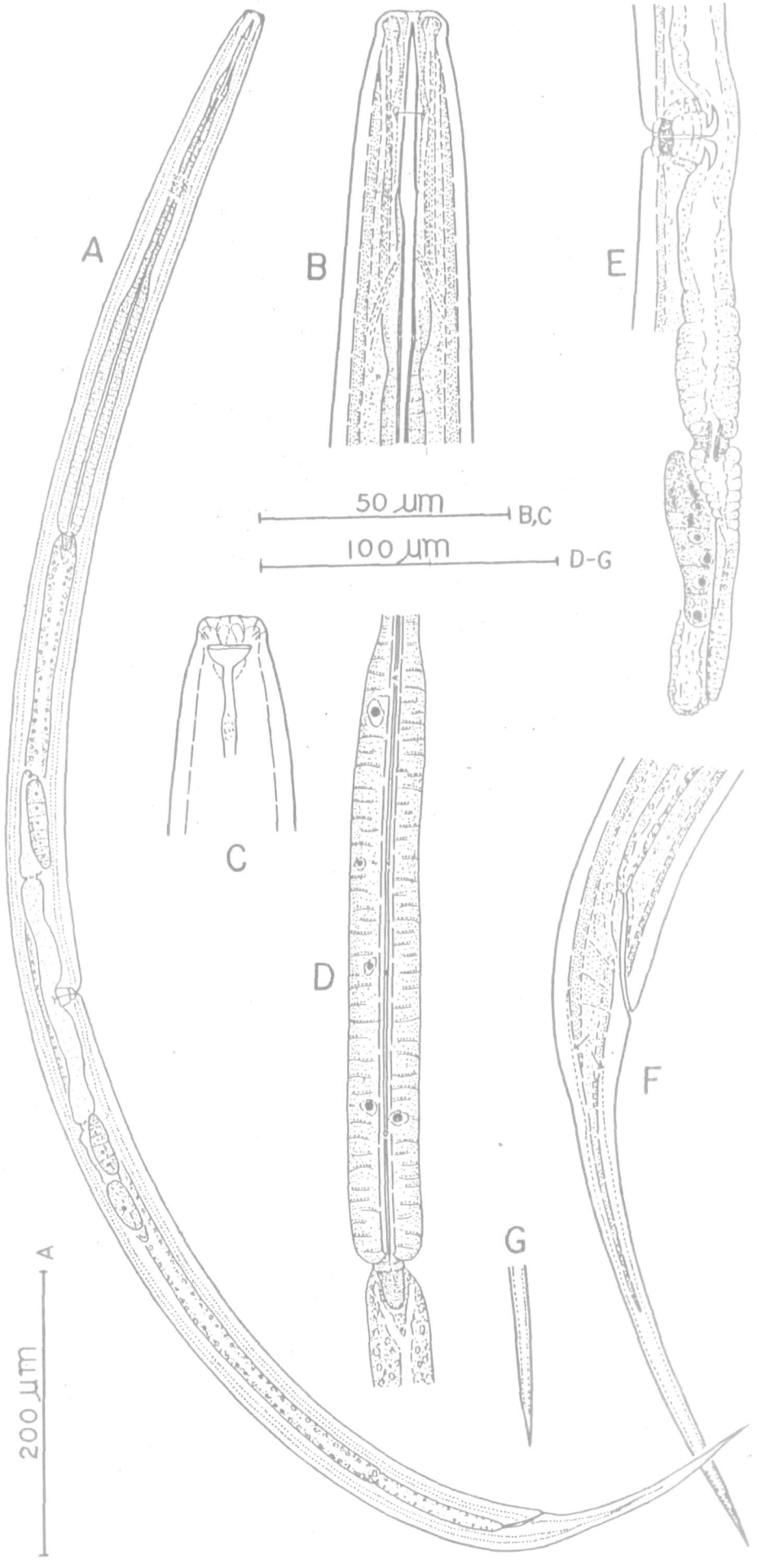

A
B
E
50 µm
B,C
100 µm
D-G
C
D
F
G
A
200 µm

Fig. 14

Laimydorus coomansi sp. n.

A - Entire female,

B - Anterior end,

C - Surface view of anterior end,

D - Basal expanded part of oesophagus and cardia,

E - Vulva, vagina and posterior sexual branch,

F - Female tail,

G - Entire male,

H - Posterior region of male.

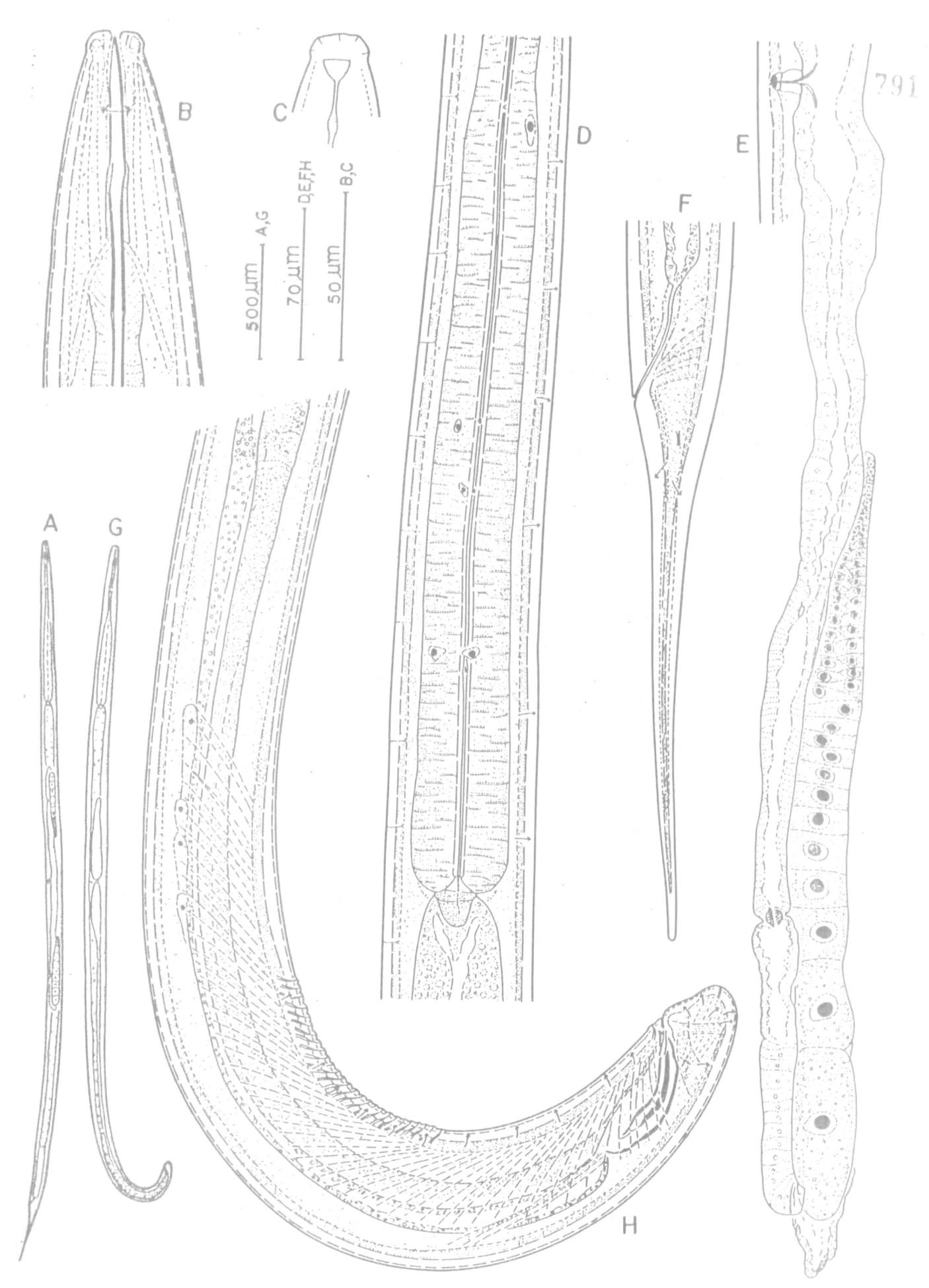

A
B
C
D
E
F
G
H
500 µm A,G
70 µm D,E,F,H
50 µm B,C

Fig. 15

Labronemella hemicaudata sp. n.

A - Entire female,

B - Anterior end,

C - Surface view of anterior end,

D - Basal expanded part of oesophagus and cardia,

E - Vulva, vagina and posterior sexual branch,

F - Posterior region of female,

G - Entire male,

H - Posterior region of male,

I - Spicule.

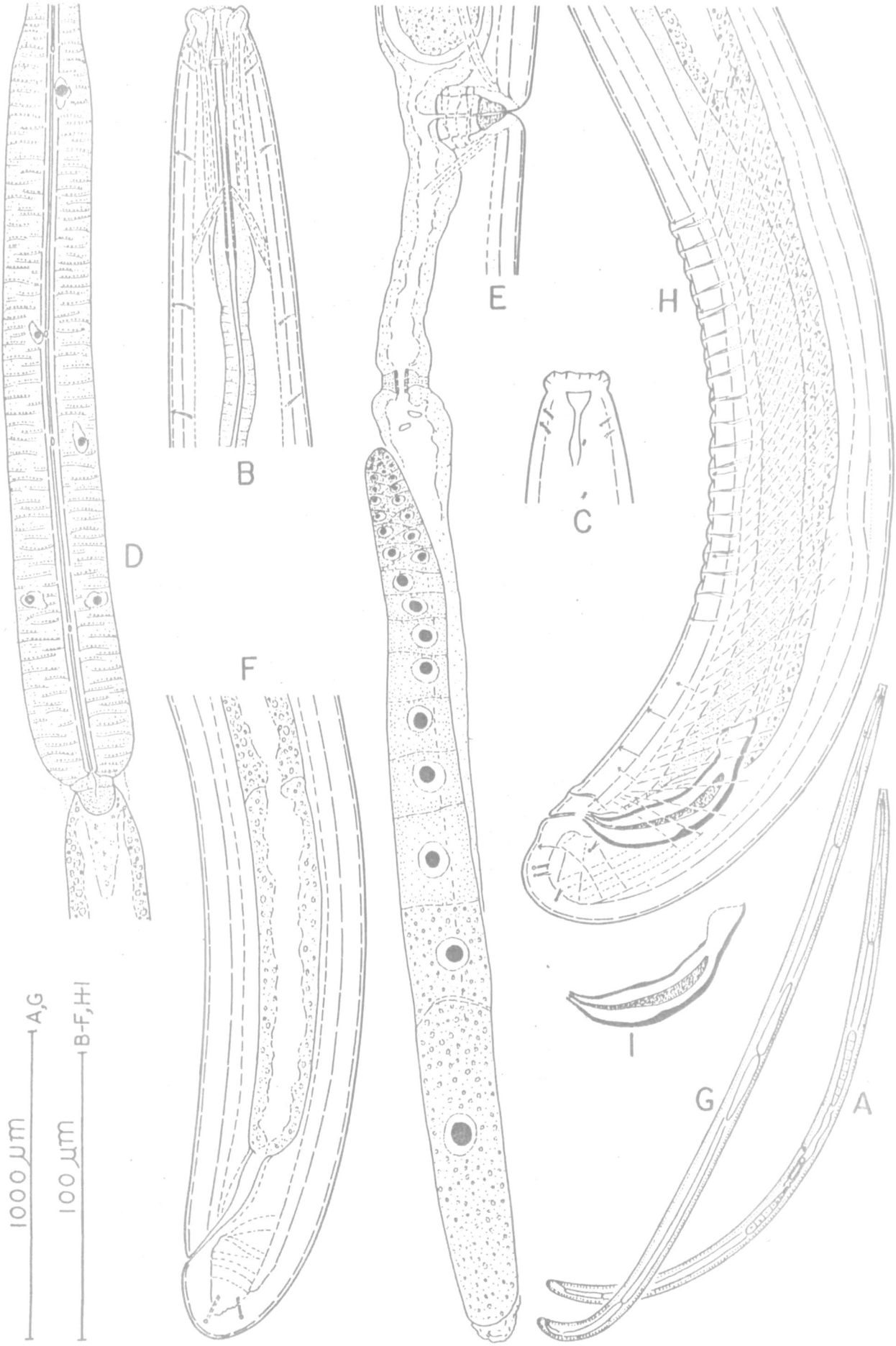

A
B
C
D
E
F
G
H
I
1000 µm
A,G
100 µm
B-F,H-I

Fig. 16

A - E: Oriverutus lobatus Siddiqi, 1971

A - Anterior end,

B - Surface view of anterior end,

C - Basal expanded part of oesophagus and cardia,

D - Female reproductive system,

E - Posterior region.

F - I: Oriverutus sundarus (Williams, 1964) Siddiqi, 1971

F - Anterior region,

G - Oesophago-intestinal junction,

H - Vulva and vagina,

I - Posterior region of female.

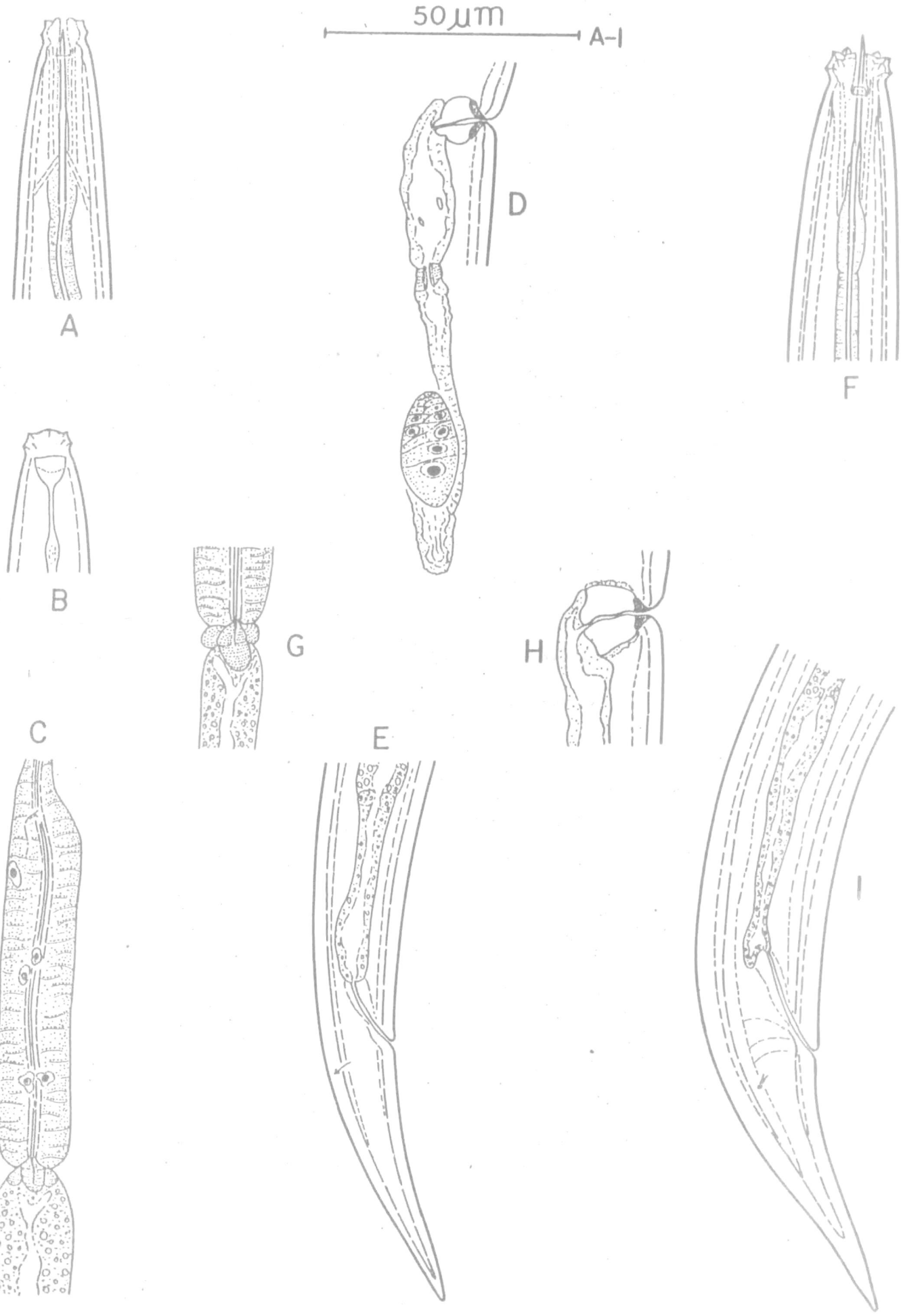

50 µm
A–I
A
B
C
D
E
F
G
H
I

Fig. 17

Oriverutus parangulatus sp. n.

A - Entire female,

B - Anterior region,

C - Surface view of anterior end,

D - Basal expanded part of oesophagus and cardia,

E - Female reproductive system,

F - Posterior region of female,

G - Posterior region.

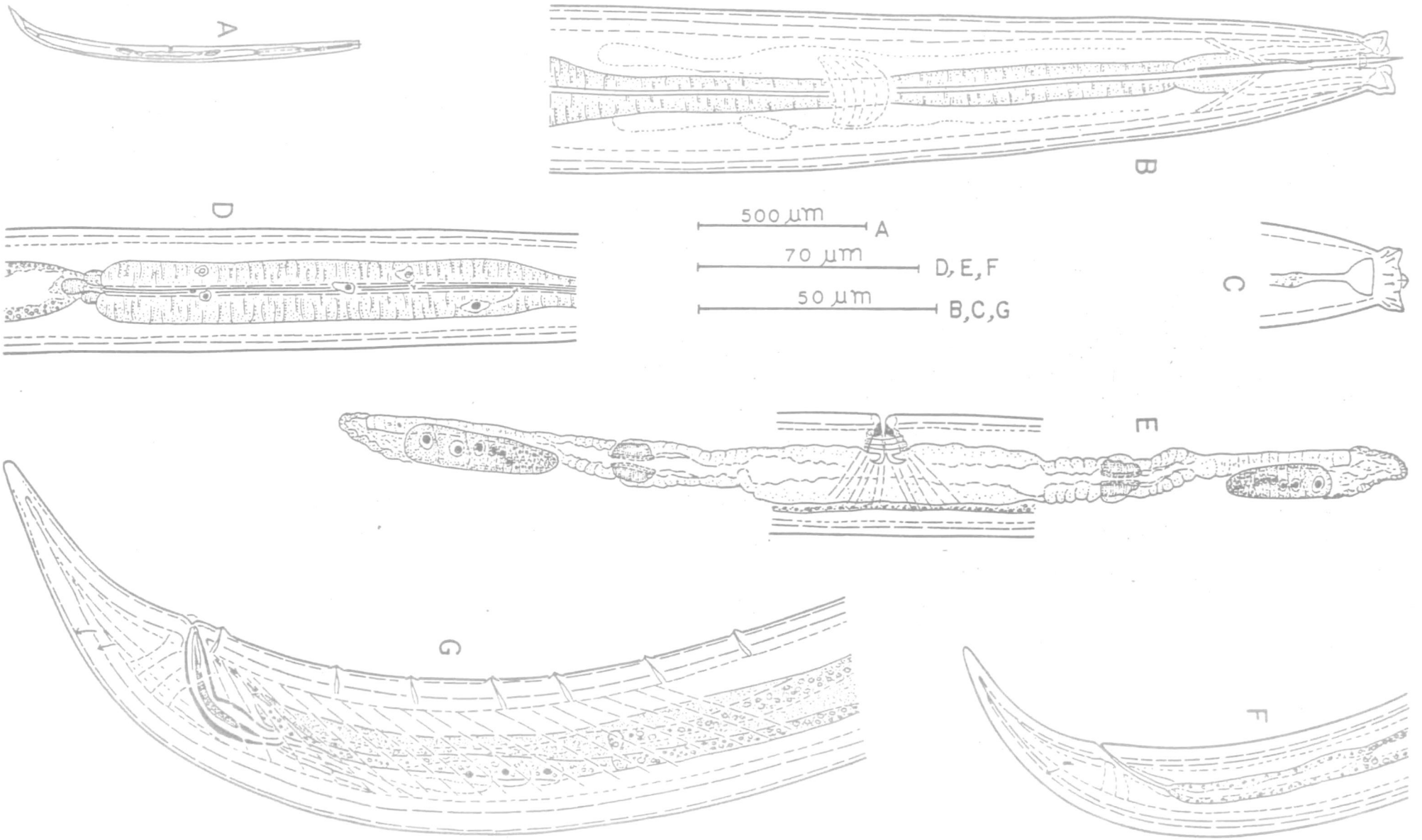

A
B
D
500 µm
A
70 µm
D, E, F
50 µm
B, C, G
C
E
G
F

Fig. 18

Saevadorella intermoidea sp. n.

A - Entire female,

B - Anterior region,

C - Surface view of anterior end,

D - Vulva, vagina and anterial sexual branch,

E - Posterior region of female,

F - Posterior region of male.

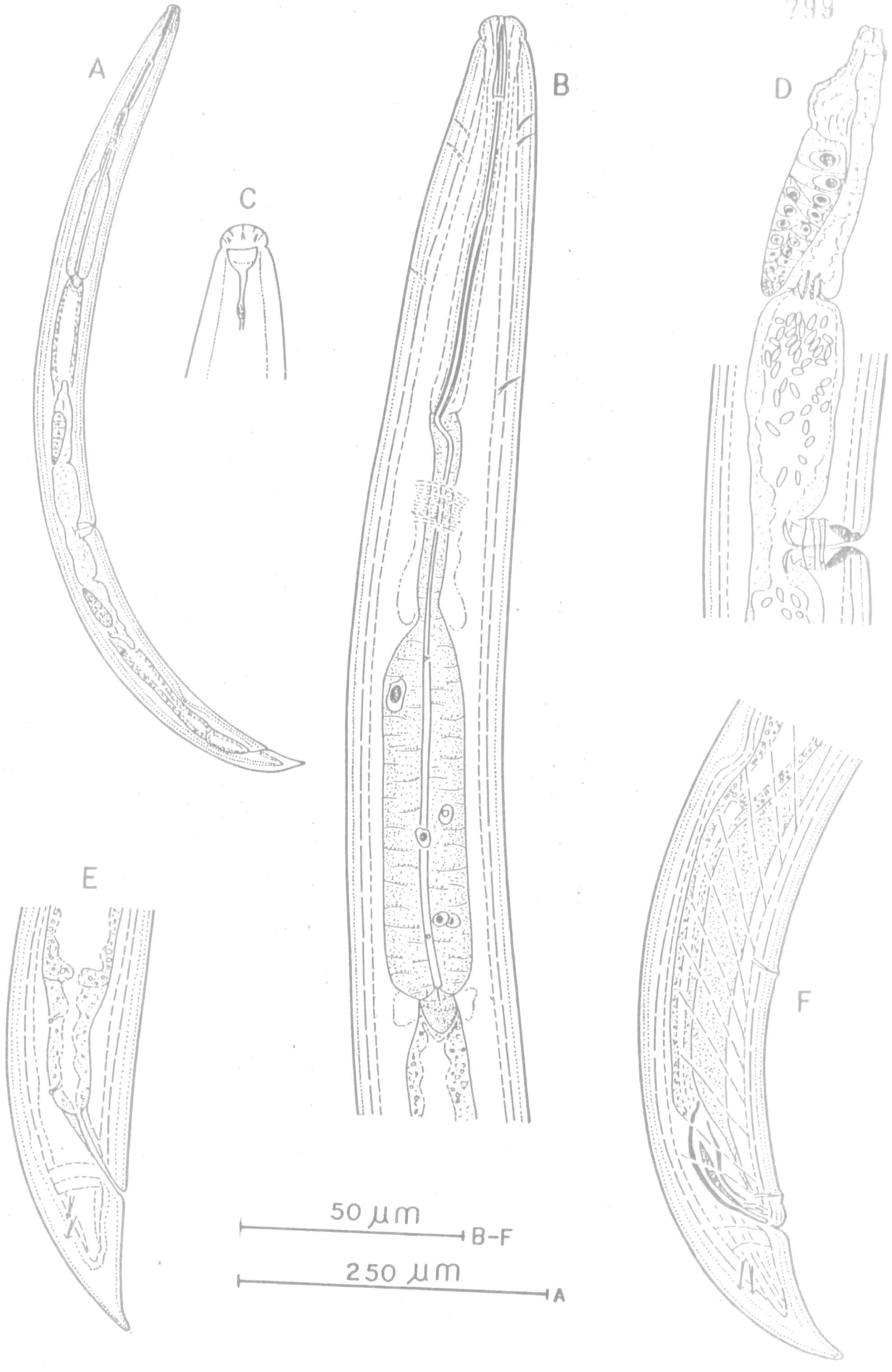

A
B
C
D
E
F
50 µm
B-F
250 µm
A

Fig. 19

Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983

A - Entire female,

B - Anterior region,

C - Amphid,

D - Female reproductive system,

E - Posterior region of female.

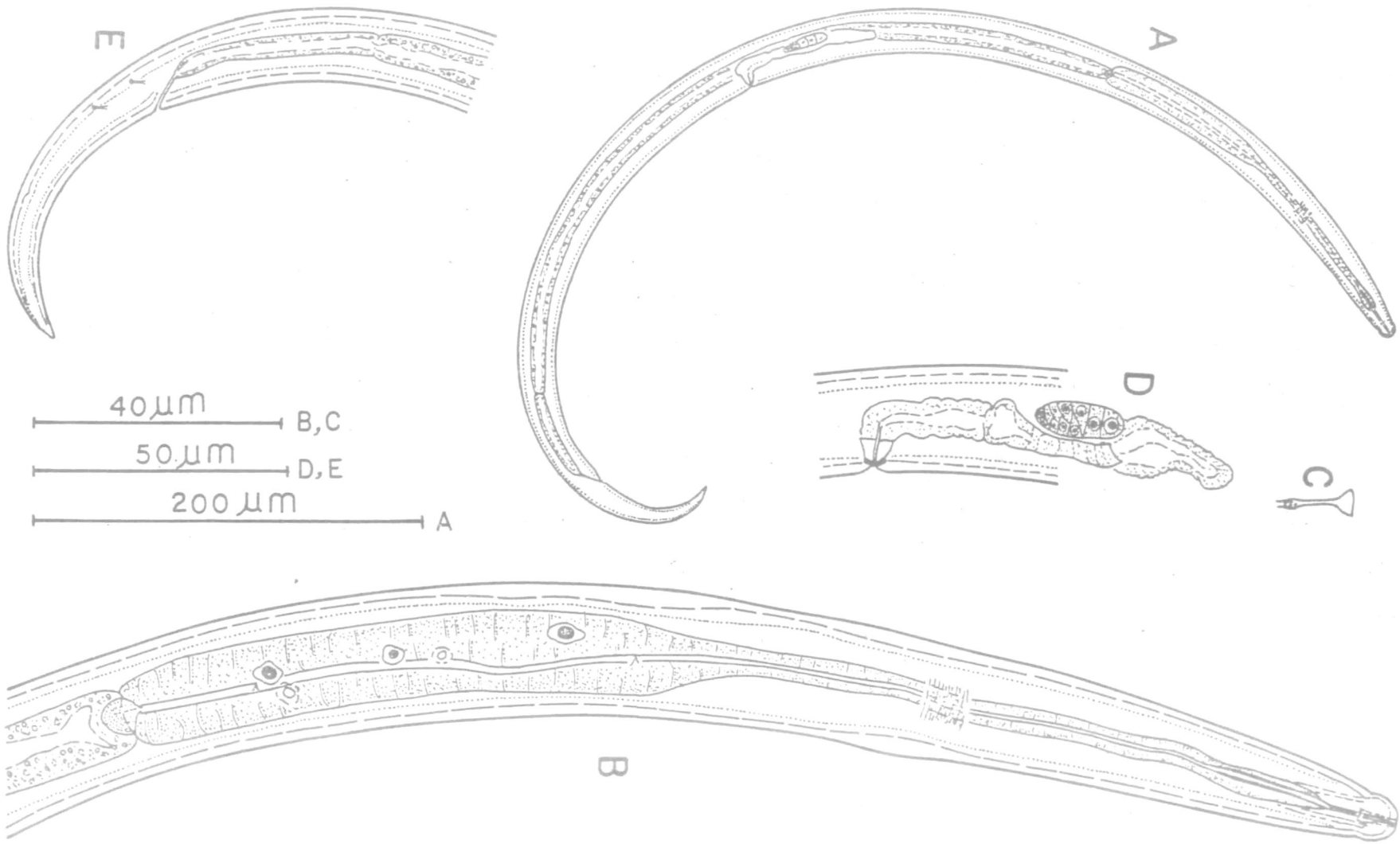

E
A
40µm
B,C
50µm
D,E
200µm
A
D
C
B

Fig. 20

A - D: Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1985

A - Anterior end,

B - Vulva region,

C - Female tail,

D - Posterior region of male.

E - I: Sclerolabia salmae sp. n.

E - Entire female,

F - Anterior region,

G - Surface view of anterior end,

H - Female reproductive system,

I - Female tail.

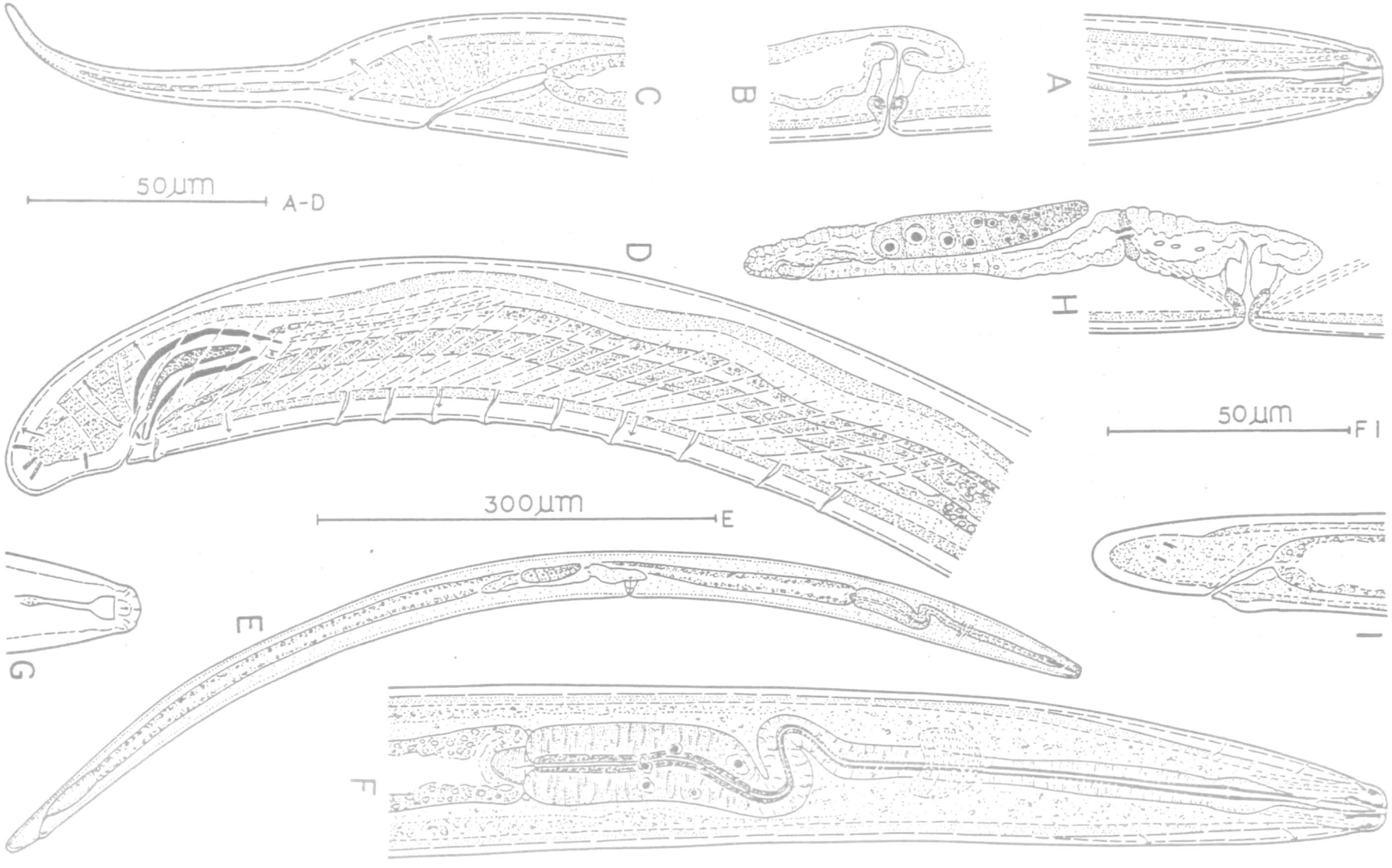

A
B
C
50µm
A-D
D
H
50µm
F I
300µm
E
I
G
E
F

Fig. 21

Anorcelaimellus atheri sp. n.

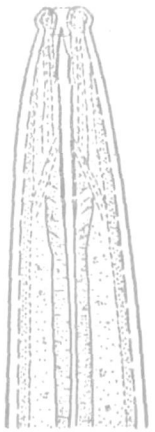
A - Entire female,

B - Anterior end,

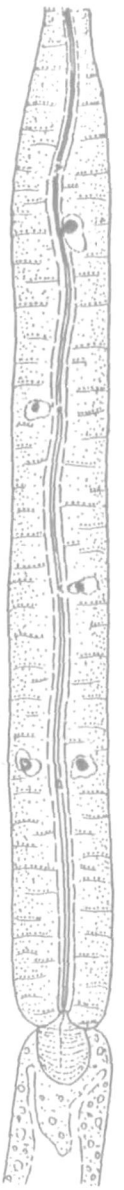
C - Basal expanded part of oesophagus and cardia,

D - Female reproductive system,

E - Female tail.

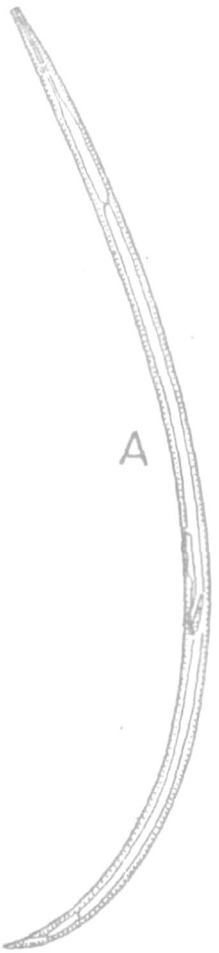


B

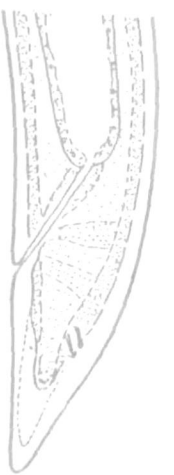


C

D



A



E

500 µm — A

50 µm — B-E

Fig. 22

A - D: *Xiphinema insigne* Loos, 1949

A - Anterior region,

B - Amphid,

C - Vulva region,

D - Female tail.

E - I: *Xiphinema brevicolle* Lordello & Costa, 1961

E - Anterior region,

F - Amphid,

G - Female reproductive system, anterior sexual branch taking turn to posterior of vulva,

H - Female posterior sexual branch taking turn to anterior of vulva,

I - Female tail.

J - L: *Paratrichodorus* (*Atlantodorus*) *porosus* (Allen, 1957) Siddiqi, 1974

J - Anterior region,

K - Vulva region showing ventromedian pores on either side of vulva,

L - Posterior end.

A
B
C
D
E
F
G
H
I
J
K
L
50 µm
J-L
100µm
A-I

Fig. 23

A - C: Dorylaimellus indicus Siddiqi, 1964

A - Anterior end,

B - Surface view of anterior end,

C - Female tail.

D - G: Dorylaimellus murtazai sp. n.

D - Entire female,

E - Anterior region,

F - Vulva, vagina and posterior sexual branch

G - Female tail.

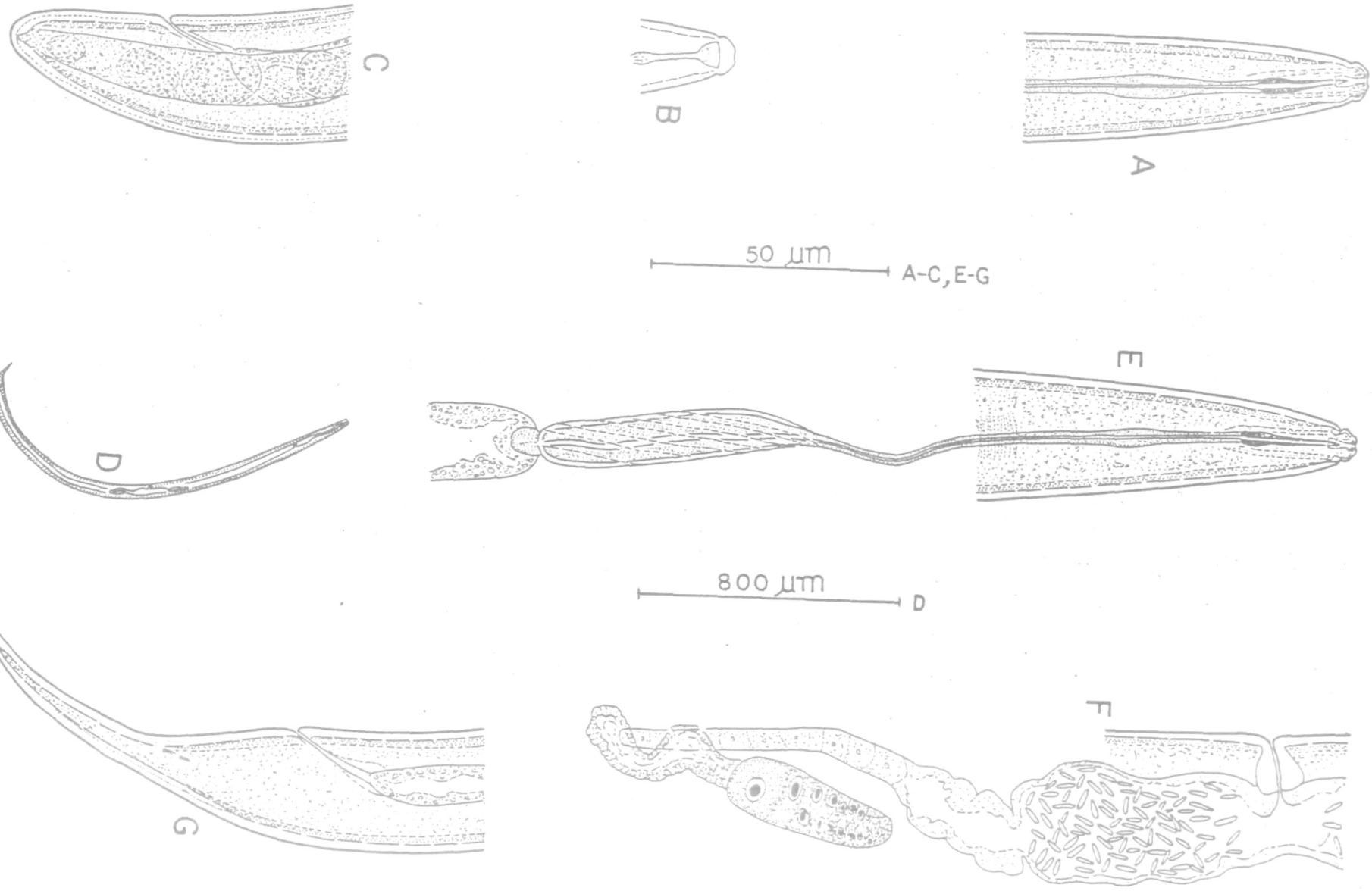

C
B
A
50 µm
A-C, E-G
D
E
800 µm
D
G
F

Fig. 24

A - C: Tylencholaimus obscurus Jairajpuri, 1965

A - Anterior region,

B - Female reproductive system,

C - Posterior region of female.

D - F: Tylencholaimus micronamus Yeates, 1979

D - Anterior region,

E - Female reproductive system,

F - Posterior region of female.

G - I: Tylencholaimus pakistanensis Timm, 1964

G - Anterior region,

H - Female reproductive system,

I - Posterior region of female.

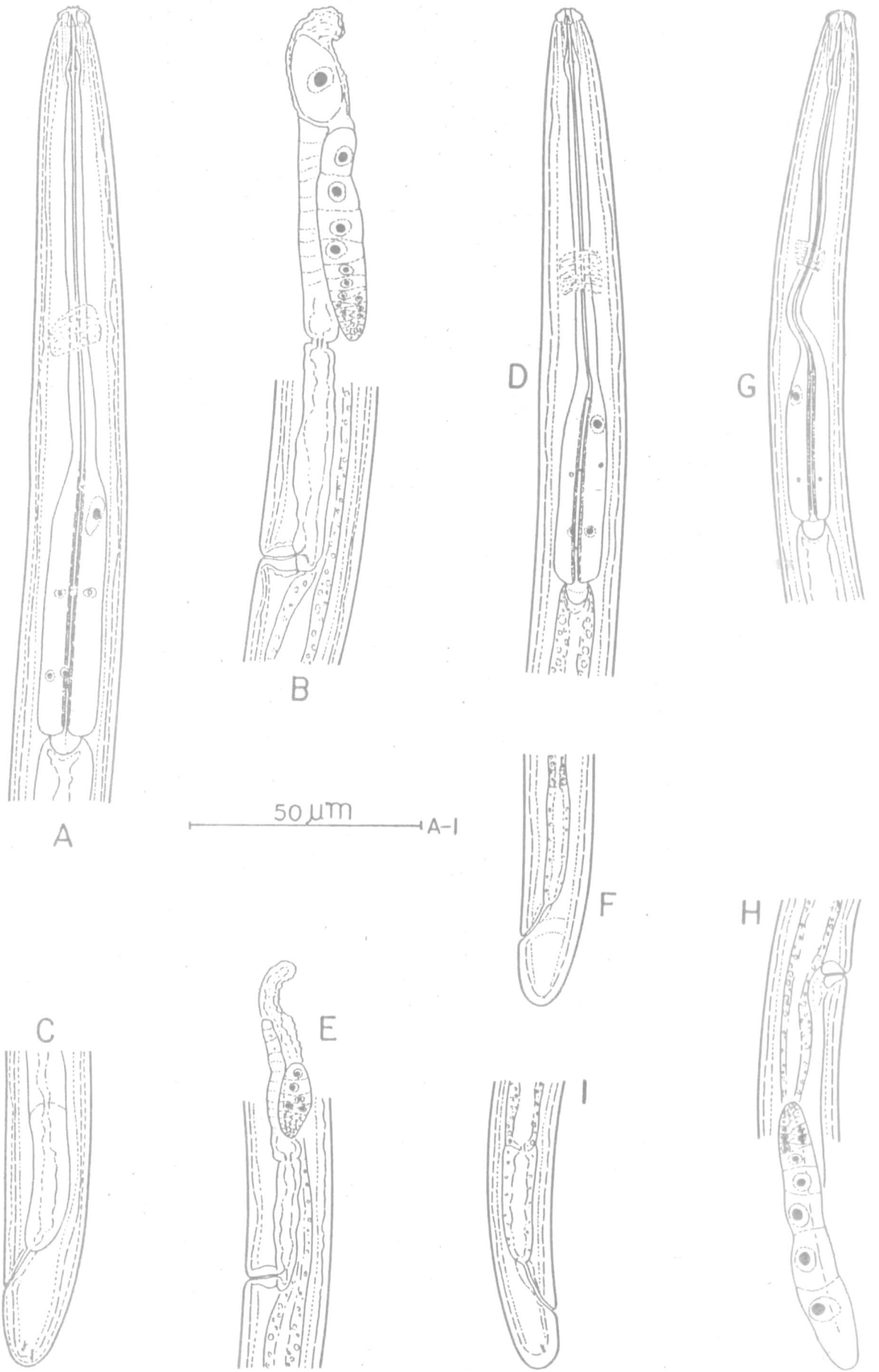

A
B
D
G
50 µm
A-I
F
H
C
E
I

Fig. 25

A - D: Prolentonchus clarus Timm, 1964

A - Anterior end,

B - Basal oesophageal bulb and cardia,

C - Female reproductive system,

D - Female tail.

E - H: Tylenchus variabilis Jairajpuri & Loof, 1966

E - Anterior end,

F - Basal oesophageal bulb and vulva region,

G - Female tail,

H - Posterior region of male.

I - L: Neoactinolaimus agilis Thorne, 1967

I - Anterior end,

J - Female tail,

K - Vulva in dorso-ventral view,

L - Posterior region of male.

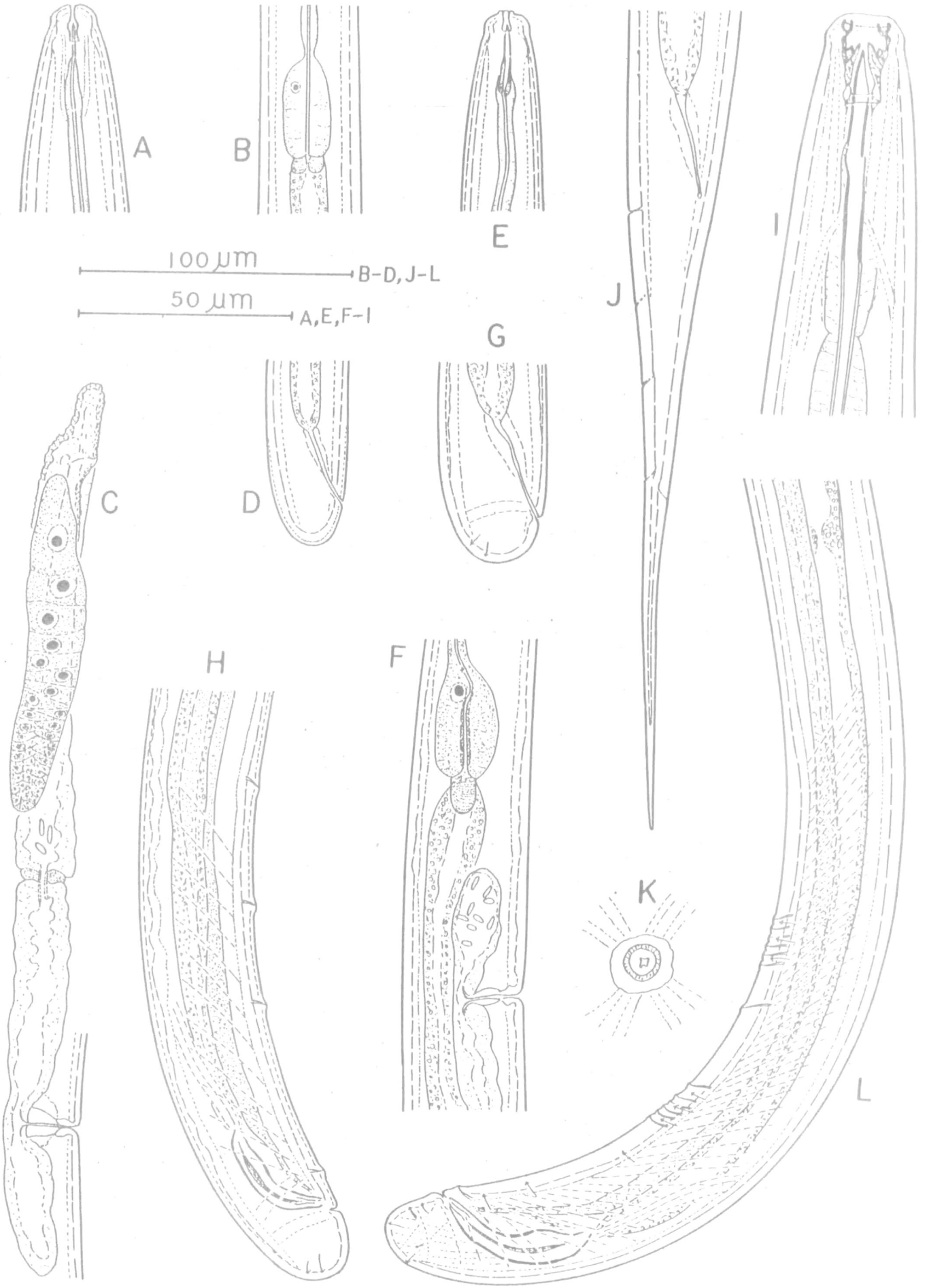

A
B
E
100 µm
B-D, J-L
50 µm
A, E, F-I
G
J
I
C
D
H
F
K
L

Fig. 26

A - C: Axonchium (Axonchium) phookani Rahman, Jairajpuri & Ahmad, 1985

A - Anterior end,

B - Female tail,

C - Posterior end of male showing spicules,

D - F: Basirotylentus caudatus Jairajpuri, 1966

D - Anterior end,

E - Vulva region,

F - Female tail.

G - I Basirotylentus pini Siddiqi & Khan, 1965

G - Anterior end,

H - Vulva region,

I - Female tail.

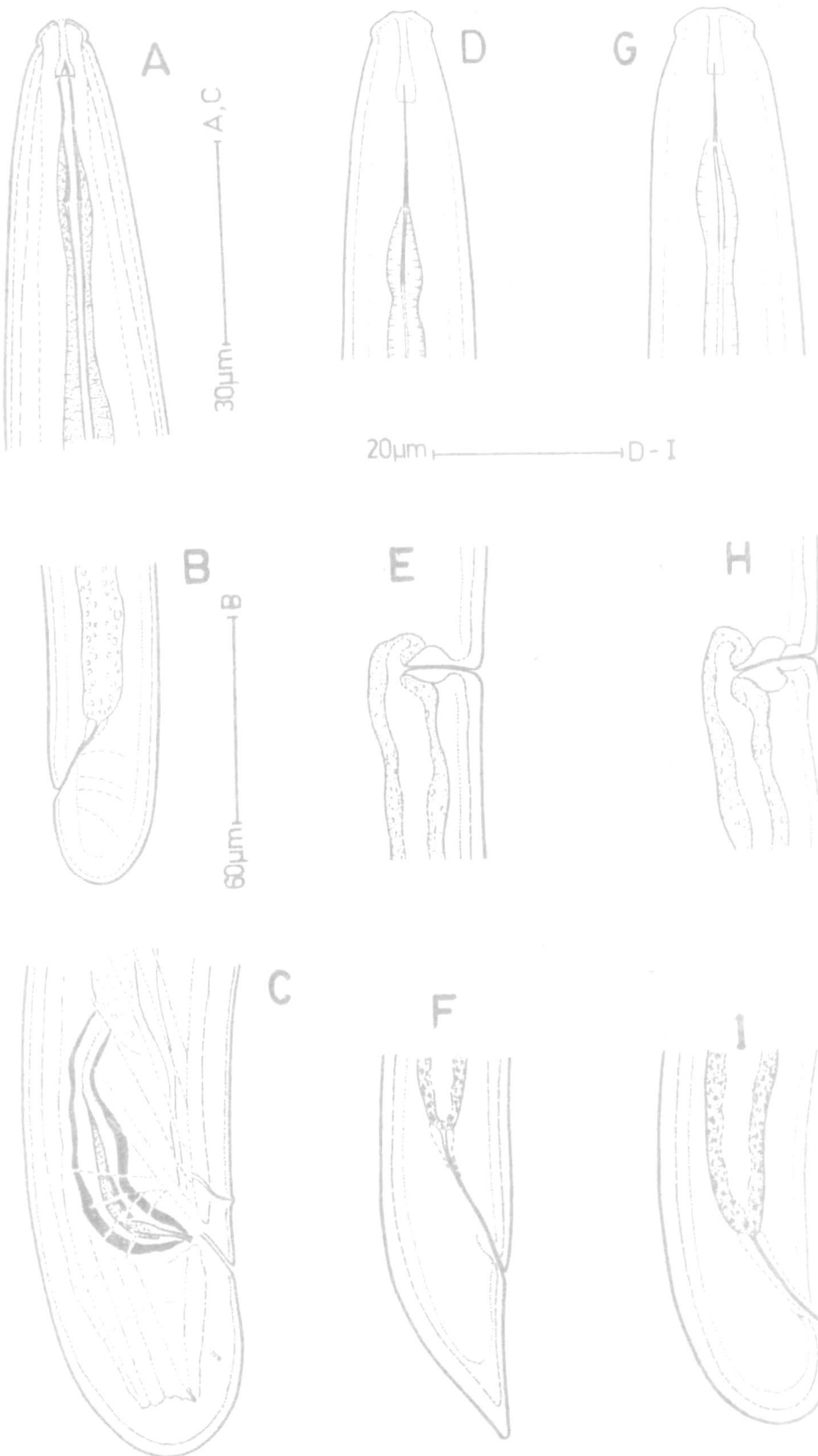

A
A,C
30µm
D
G
20µm
D - I
B
B
60µm
E
H
C
F
I

Fig. 27

A - C: Dorylaimoides micoletzkyi (de Man, 1921) Thorne & Swanger, 1936

A - Anterior end,

B - Female tail,

C - Posterior region of male.

D - F: Dorylaimoides longiurus Siddiqi, 1965

D - Anterior end,

E - Female reproductive system,

F - Female tail.

G - J: Discomyctus cephalatus

G - Anterior end,

H - Oesophago-intestinal junction,

I - Vulva and vagina,

J - Female tail.

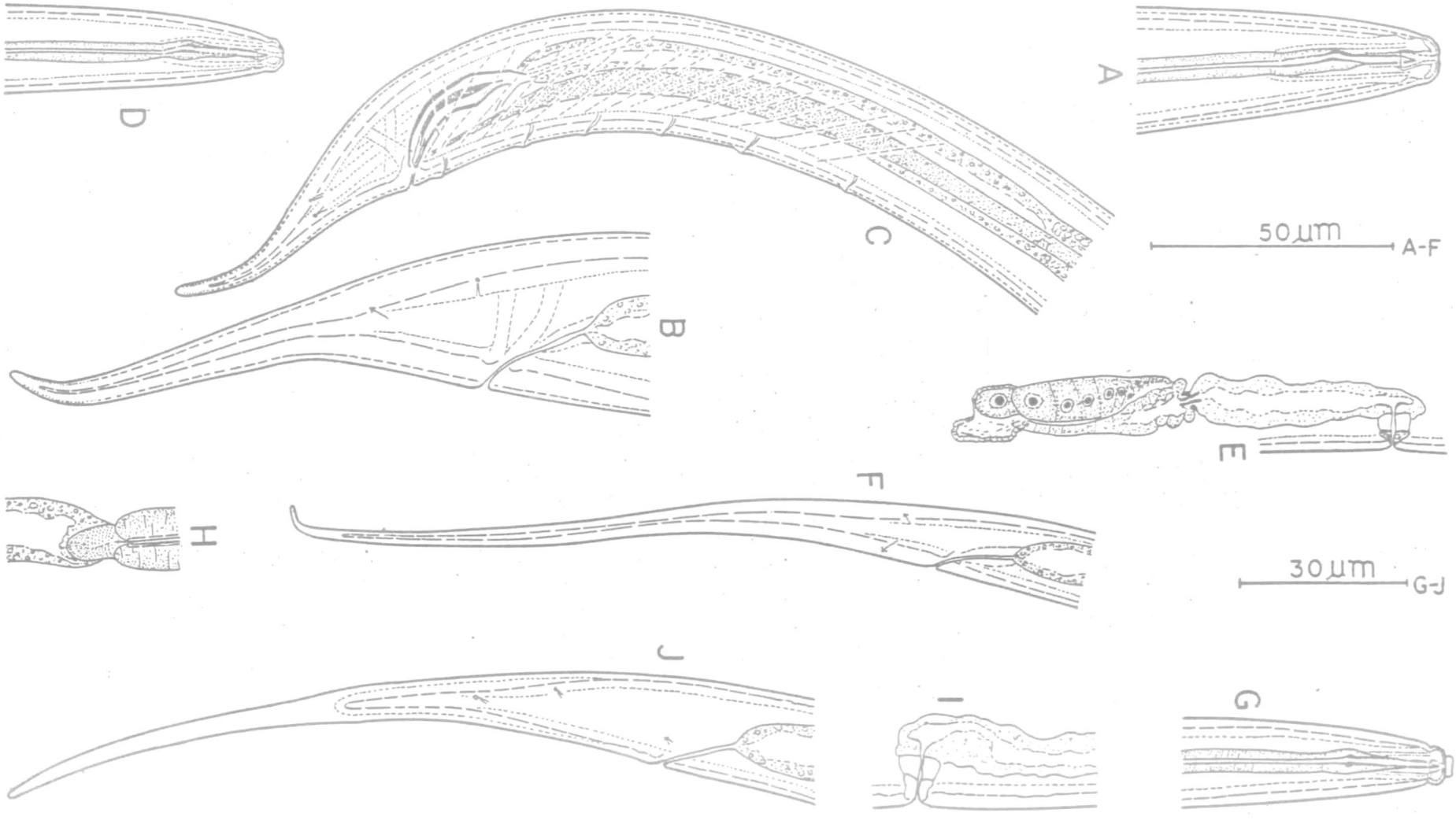

A
B
C
D
E
F
G
H
I
J
50 µm
A-F
30 µm
G-J

Fig. 28

Dorylaimoides mujtabai sp. n.

A - Entire female,

B - Anterior region,

C - Surface view of anterior end,

D - Female reproductive system,

E - Posterior region of female,

F - Posterior region of male.

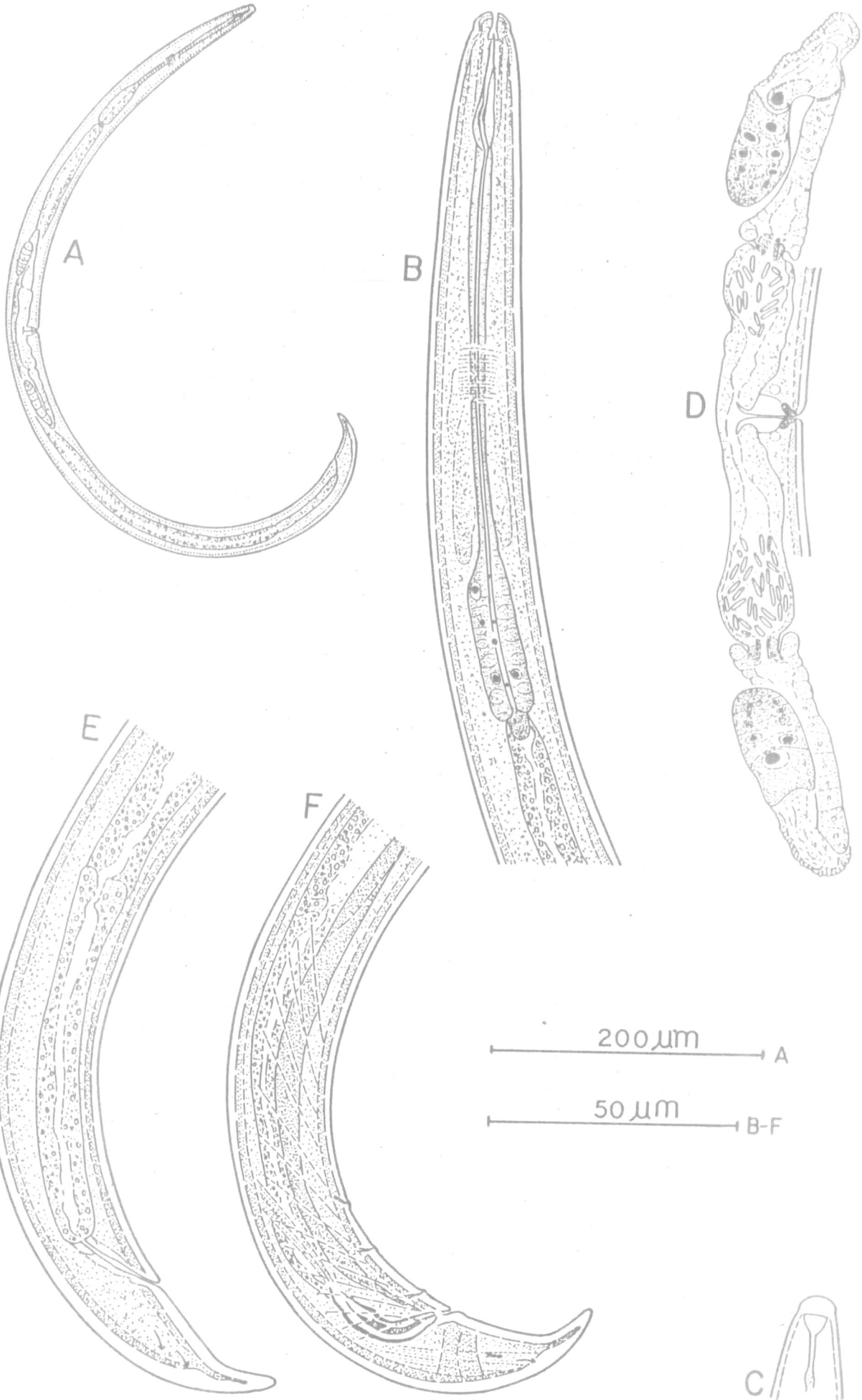

A
B
D
E
F
200 µm
A
50 µm
B-F
C

Fig. 29

A - D: Mononchus truncatus Bastian, 1865

A - Anterior end,

B - Oesophago-intestinal junction,

C - Vulva region,

D - Female tail.

E - F: Clarkus elongatus Jairajpuri & Khan, 1977

E - Anterior end,

F - Female tail.

G - H: Prionchulus muscorum Dujardin, 1845

G - Anterior end,

H - Female tail.

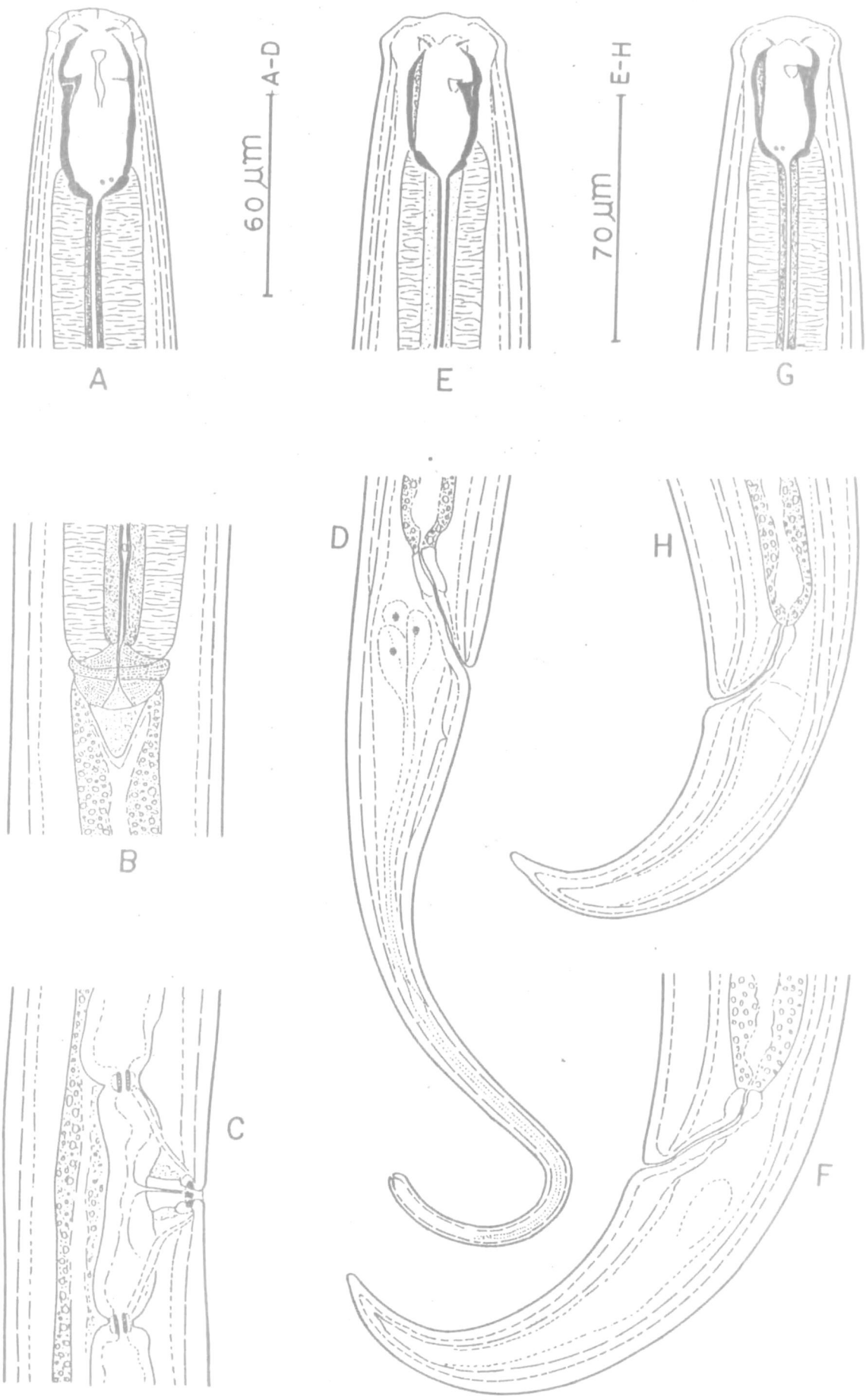

A-D
60 µm
E-H
70 µm
A
E
G
B
D
H
C
F

Fig. 30

A - B: Mylonchulus brachyuris (Butschli, 1873) Altherr, 1954

A - Anterior end,

B - Female tail.

C - D: Mylonchulus hawaiiensis (Cassidy, 1931) Andrassy, 1958

C - Anterior end,

D - Female tail.

E - G: Mylonchulus contractus Jairajpuri, 1970

E - Anterior end,

F - Female reproductive system,

G - Female tail.

H - I: Mylonchulus amurus Khan & Jairajpuri, 1979

H - Anterior end,

I - Female tail.

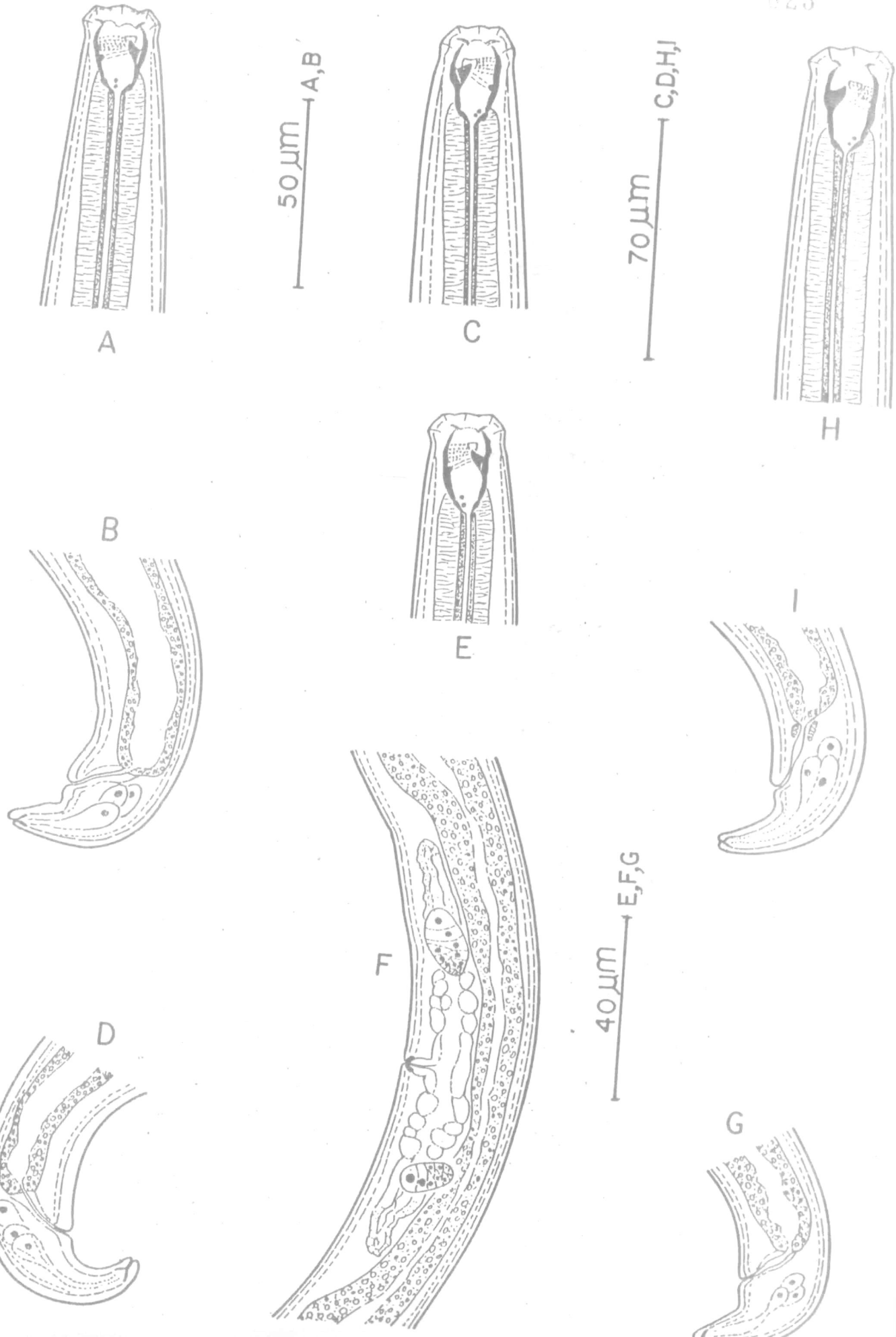

A
50 µm
A,B
C
70 µm
C,D,H,I
H
B
E
I
F
40 µm
E,F,G
D
G

Fig. 31

A - B: Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan, 1982

A - Anterior end,

B - Female tail.

C - D: Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982

C - Anterior end,

D - Female tail.

E - H: Parahadronchus shakili (Jairajpuri, 1969) Mulveyi , 1978

E - Anterior end,

F - Vulva region,

G - Female tail,

H - Posterior region of male.

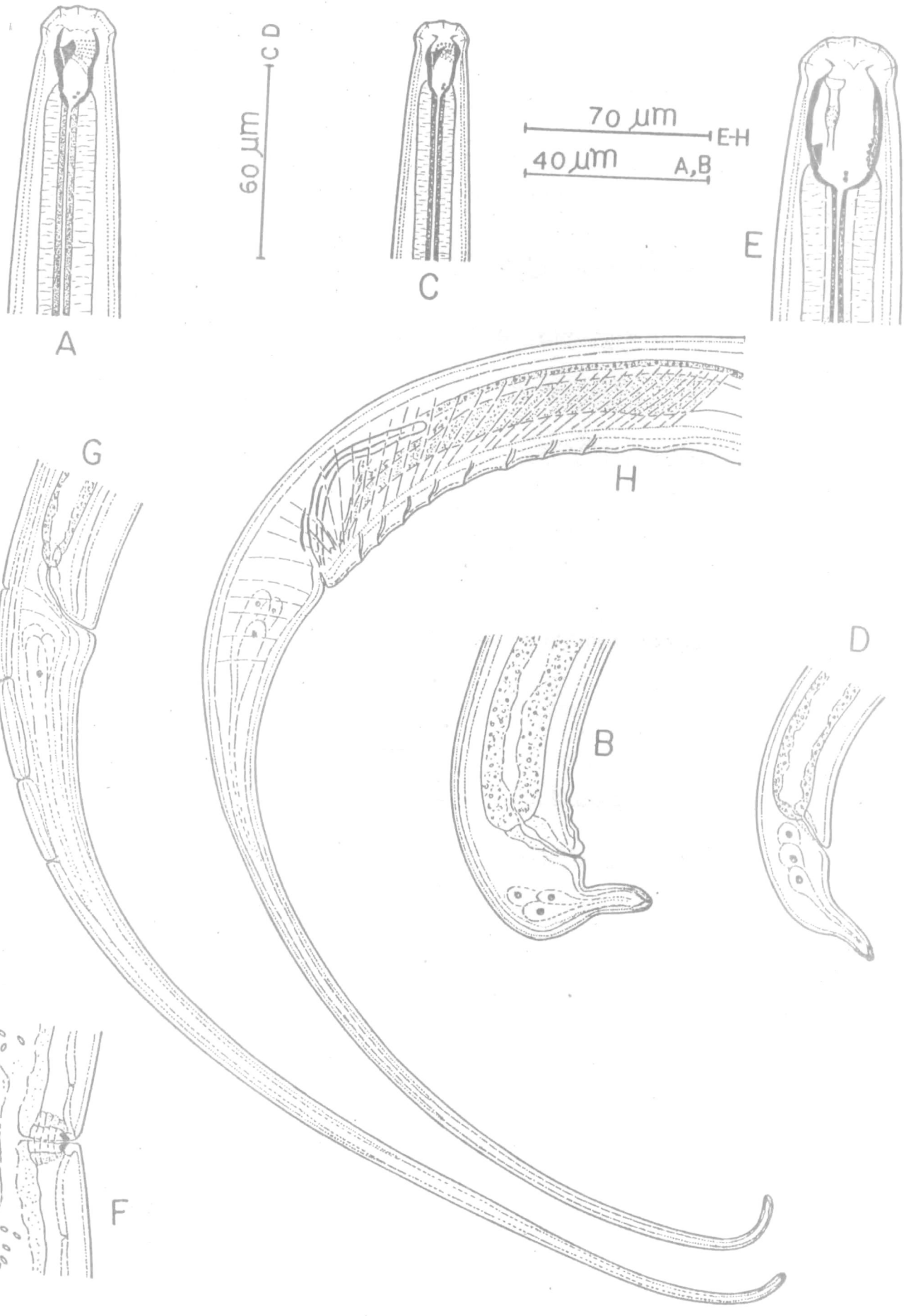

A
60 µm
C D
C
70 µm
E-H
40 µm
A,B
E
G
H
B
D
F

Fig. 32

A - D: Iotonchus navari Mohandas & Prabhoo, 1979

A - Anterior end,

B - Female tail,

C - Posterior region of male, Sang population,

D - Posterior region of male, Gyalshing population,

E - F: Iotonchus indicus Jairajpuri, 1969

E - Anterior end,

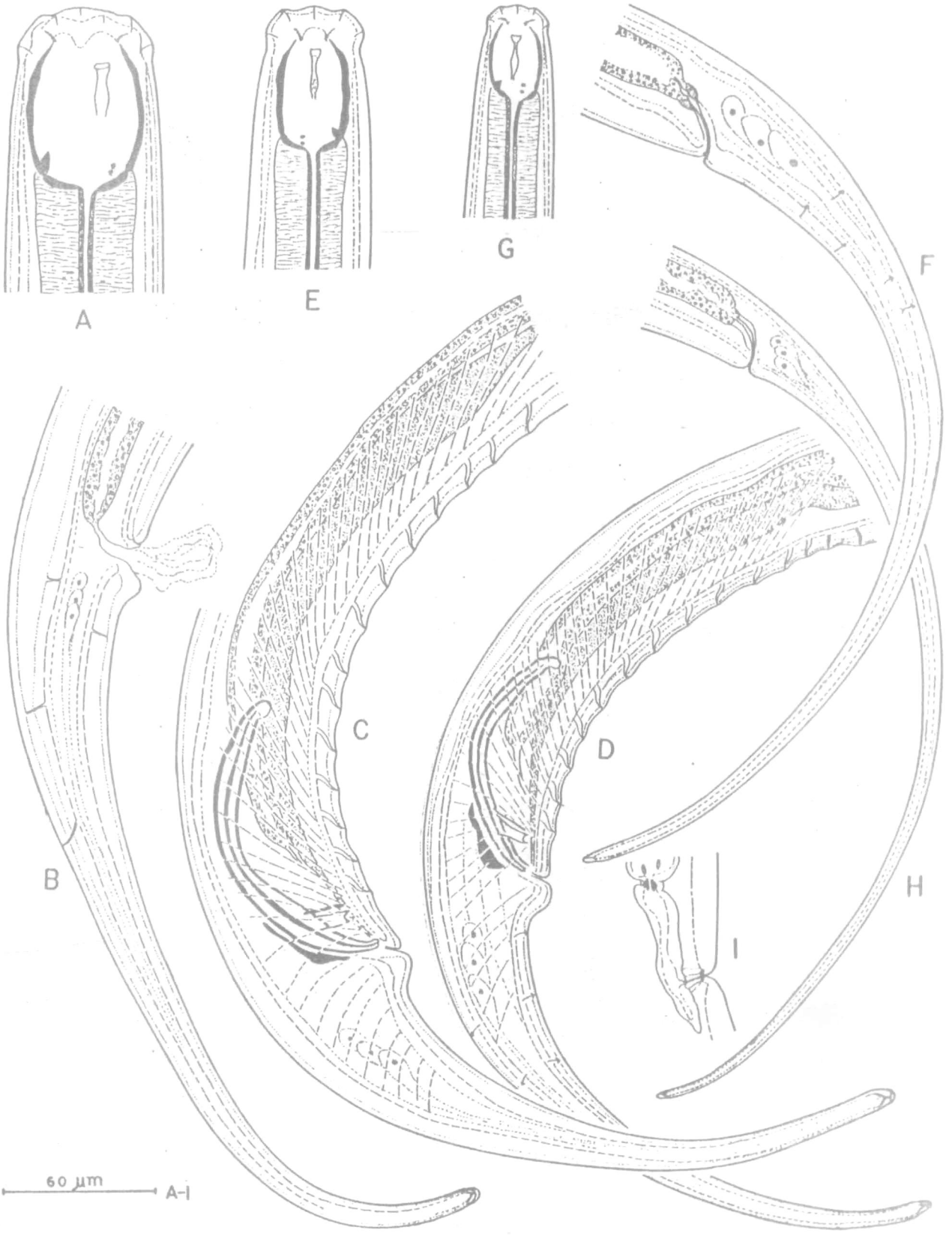
F - Female tail.

G - I Iotonchus longicaudatus Baqri, Baqri & Jairajpuri, 1978

G - Anterior end,

H - Female tail,

I - Vulva region.


A
E
G
F
B
C
D
H
I
60 µm
A-I

CONTENTS

Bull. zool. Surv. India, 5 (2 & 3) : 85-91, 1984

EVALUATION OF YIELD LOSSES IN RICE DUE TO *HIRSCHMANNIELLA GRACILIS* (de MAN, 1880) LUC & GOODEY, 1963 (TYLENCHIDA : NEMATODA) AT HOOGHLY (WEST BENGAL)

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Zoological Survey of India, Calcutta

ABSTRACT

During monsoon season in 1979, an experiment was conducted at Chinsurah Rice Research Station, District Hooghly (West Bengal) to estimate the yield losses in paddy crop due to *Hirschmanniella gracilis*. The seedlings of 'Jaya' variety of rice were transplanted on 18th August, 1979. The field was divided into 24 subplots (4×4 m each) in which the following treatments were replicated six times and randomized : T_1=Treated with carbofuran granules, T_2=Native population of *H. gracilis*, T_3=Inoculation to soil by incorporating 500 gm/subplot infested chopped roots (4300 nematodes), T_4=Inoculation to soil by incorporating 1 Kg/subplot infested chopped roots (8600 nematodes).

The loss was again estimated during the monsoon season in 1981 by applying the same dose of carbofuran granules. This time, the chopped roots were not incorporated in the main field because of their insignificant role in 1979. Instead of T_3 and T_4 treatments mentioned above in 1979, a new treatment was introduced in 1981 by treating half of the seed bed by carbofuran granules.

The results reveal that the application of carbofuran granules brings down the population of *H. gracilis* in soil as well as in roots significantly. In treated subplots, the significant improvement in the root and shoot length, plant and root weight and the yield has been found directly related with the decline of *H. gracilis* population in soil and roots. The loss in yield due to native/inoculated population of *H. gracilis* has been calculated 12·05 to 13·61% in 1979 and 18·33 to 19·22% in 1981.

INTRODUCTION

During recent years, a considerable work has been done on different aspects of nematode pests associated with paddy crop in India (Das & Rao, 1970 ; Mathur & Prasad, 1971, '74a', '74b', '74c' ; Muthukrishnan, *et al.*, 1979 ; Prasad & Rao, 1974 ; Ramana & Rao, 1977 ; Rao, 1970. Mathur & Prasad (1971) reported that *Hirschmanniella oryzae* (Soltwedel, 1889) Luc & Goodey, 1963 occurs at least in 12 states of the Indian union. Recent reports from different research centres have revealed that *Hirschmanniella* spp. are most serious and widely distributed pests of rice. Baqri *et al.*, (1983) have reported that every paddy field in Burdwan district of W. Bengal was found infested by *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963.

Several field experiments have been conducted by various workers at Thailand and Japan to evaluate the yield losses in rice

caused by the rice root nematodes by applying different dosages of different chemicals (DD, EDB, DBCP, etc.). In India, Panda & Rao (1971) and Rao & Biswas (1974) have estimated the yield losses in rice under inoculated conditions in pots caused by *Hirschmanniella mucronata* (Das, 1960) Luc & Goodey, 1963 and *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949 respectively.

The present investigations were initiated in 1979 at Chinsurah Rice Research Station, Hooghly (W. Bengal) by applying carbofuran granules and inoculating *H. gracilis* in an already infested field from the same species. Applying the same dose of carbofuran granules, the results were confirmed in 1981.

Carbofuran was selected because it has been reported to be effective against various plant parasitic nematodes by bringing down their population (Di Sanzo, 1969 ; Di Sanzo, 1973 ; Siddiqui & Khan, 1974 ; Overman & Jones, 1975 ; Bonnemaison, 1975 ; Verma *et al.*, 1978 ; Varma, Prasad & Mathur, 1980 ; and others). Moreover, carbofuran in granular form is not only less expensive but also easily available in the market.

Materials and Methods

The nursery bed of 'Jaya' variety was prepared in an adjacent field during July 1979. The main field was divided into 24 subplots (4 × 4 m each) which were separated from each other by 0·5 m bund. One month old seedlings were transplanted on 18th August, 1979 at 15 × 20 cm space. Recommended cultural practices of rice were followed. No other pesticides or weedicides were applied in the field during the present course of investigation. In the main field, the following four treatments were replicated six times and randomised :

T_1 = Treatment with carbofuran granules 1 Kg. a.i./ha, one day before seedlings transplantation and 50 days after seedlings transplantation.

T_2 = Native population in the soil.

T_3 = Inoculation to soil by incorporating 500 gm/subplot infested chopped roots (4300 nematodes).

T_4 = Inoculation to soil by incorporating 1 Kg./subplot infested chopped roots (8600 nematodes).

The loss assessed in 1979 was confirmed by conducting another experiment at Chinsurah during the monsoon season in 1981. The same dose of carbofuran granules was applied in the main field. This time, a new presowing treatment was introduced by treating half of the seed bed by carbofuran granules (1 Kg. a.i./ha). The seed bed treatment was introduced to assess the loss in growth of seedlings due to rice root nematodes. T_3 and T_4 treatment, mentioned above, were not taken into consideration because the inoculation of *H. gracilis* by incorporating infested chopped roots did not make any significant difference in 1979. The following three treatments were replicated eight times and randomised in 1981.

T_1 = Main field treated with carbofuran granules, seedlings from carbofuran treated seed bed.

T_2 = Main field with native population, seedlings from carbofuran treated seed bed.

T_3 = Main field with native population, seedlings from untreated seed bed.

The soil samples were collected from five spots at random from each subplots for counting *H. gracilis* population a day before inoculation or first application of carbofuran granules. 30 days after seedlings transplantation, prior to second application of carbofuran granules and prior to hervesting. The *H. gracilis* population was counted from 200 ml soil. From each subplot, 10 plants were rooted out on the day of each sampling to note the length of root and shoot (cm), number of flowering/nonflowering tillers, weight of total plant and roots separately (gm) and also the nematode population in 5 gm roots.

The extraction of nematodes was done through modified Baermann funnel technique. From roots, the nematodes were recovered by placing chopped roots through blender over Baermann funnel.

RESULTS AND DISCUSSION

All the results obtained in 1979 have been analysed in Table I. The initial population of *H. gracilis* was counted 70/200 ml soil. It is evident from the results that *Hirschmanniella* population in soil becomes considerably low in treated subplots on 30th day after transplanting seedlings whereas it increases in untreated/inoculated subplots (12 against 94-158). It appears that the application of carbofuran granules in soil also checks the penetration of *Hirschmanniella* into the roots because 7 nematodes/5 gm roots were recovered against 34-86/5 gm roots from untreated or inoculated subplots. A marked improvement in shoot and root length, root weight and plant weight from treated subplots was noted over the untreated or inoculated subplots.

The sampling prior to second application of carbofuran granules revealed that the *Hirschmanniella* population has increased in the treated soil and the differences in the population among treated and untreated/ inoculated subplots did not remain significant except T_4 over T_1, T_2 and T_3 at 5% level. During this period the root population also increased in T_1 subplots and the differences among the different treatments did not remain significant. The length and weight of roots and shoots in the plants from treated subplots continued to be significant over the plants from T_2, T_3 and T_4 subplots.

The third or pre-harvesting sampling again confirmed the efficacy of carbofuran, since the soil and root population of *Hirschmanniella* declined after the second application of this pesticide in T_1 subplots. The soil and root population of *H. gracilis* became significantly low in T_1 subplots. The number of flowering tillers was significant in the treated subplots. In addition to this, shoot length, root weight and plant weight were also noted significant in T_1 subplots. Though at this stage the weight of roots and shoots do not remain of much importance because the plants have to prepare for the grain yield.

Finally, the following results of yield grain were recorded from the four treatments : $T_1 = 6{\cdot}575$ Kg., $T_2 = 5{\cdot}983$ Kg., $T_3 = 5{\cdot}683$ Kg., $T_4 = 5{\cdot}783$ Kg.

It is evident that the enhanced grain yield in T_1 subplots over T_2, T_3 and T_4 subplots is obtained due to the application of carbofuran granules which checks the population of *Hirschmanniella* at low level. Since the increase in yield is due to controlled population of *Hirschmanniella* sp. in T_1 subplots,

TABLE I. Losses in paddy yield due to *Hirschmanniella gracilis*

Time of sampling	Treat-ments	No. of non-* flowering tillers	No. of* flowering tillers	Shoot* height (cm)	Root* length (cm)	Plant Wt* (gm)	Root Wt.* (gm)	Population* of *H. gracilis* in root (5 gm)	Population* of *H. gracilis* in soil (200 ml)	Yield (Kg)
At the time of inoculation		—	—	—	—	—	—	—	78	—
30 days after transplanting seedlings	T_1	10.6	—	57	19	35	6	6.6	12	—
	T_2	10.8	—	50	16	23	2.5	34	94	—
	T_3	10	—	48	16	17	2.4	36	158	—
	T_4	12	—	51	16	22	2.3	86	158	—
C. D. at 1%		N.S.	—	5.92	2.3	10.97	0.83	49.27	71.46	—
C. D. at 5%		N.S.	—	—	1.66	—	—	—	51.67	—
Prior to second application of carbofuran	T_1	9	0.56	76	16	83	8.3	48	141	—
	T_2	6	0.48	71	14	56	5.9	56	155	—
	T_3	9	0.35	67	15	57	6.1	87	138	—
	T_4	10	0.21	73	13	75	7.0	79	255	—
C. D. at 1%		N.S.	N.S.	7.77	N.S.	19.23	2.07	N.S.	N.S.	—
C. D. at 5%		N.S.	N.S.	5.62	1.95	—	—	N.S.	92.08	—
Prior to harvesting	T_1	—	8.5	85	10	76	4.0	4	45	—
	T_2	—	9.0	80	10	68	2.9	7	69	—
	T_3	—	9.0	82	11	79	3.4	13	91	—
	T_4	—	8.5	82	11	76	3.6	18	214	—
C. D. at 1%		—	0.29	N.S.	N.S.	N.S.	0.83	N.S.	142.75	—
C. D. at 5%		—	—	3.37	N.S.	10.63	—	11.81	103.27	—
Post harvesting	T_1	—	—	—	—	—	—	—	—	6.575
	T_2	—	—	—	—	—	—	—	—	5.983
	T_3	—	—	—	—	—	—	—	—	5.683
	T_4	—	—	—	—	—	—	—	—	5.783
C. D. at 1%		—	—	—	—	—	—	—	—	N.S.
C. D. at 5%		—	—	—	—	—	—	—	—	0.34
Loss in yield (%)			T_2=12.05		T_3=13.61		T_4=12.05			

*Mean of six replications

TABLE II. Nematode population at the time of nursery sowing 353/200 ml of soil.

Treatments	Plant growth and nematode population at the time of transplanting (Average of ten seedlings)							
	Shoot length (cm)	% increase untreated control.	Fresh root weight (gm)	% increase untreated control.	Nematode Population in soil/200 ml,	%de-crease.	Nematode population of root/5 gms.	%de-crease.
Untreated control.	24.35		0.18		170		27	
Carbofuran treated nursery @ 1 Kg/ha.	33.15	26.55%	0.24	25%	100	41.18	10	62.96

TABLE III. Losses in Paddy yield due to *Hirschmanniella gracilis*

Time of Sampling	Treatments	No. of non-* flowering tillers	No. of* flowering tillers	Shoot* height (cm)	Root* length (cm)	Plant Wt.* (gm)	Root Wt* (gm)	Population* of *H. gracilis* in root (5 gm)	Population* of *H. gracilis* in soil (200 ml)	Grain* yield (Kg.)
At the time of transplanting		—	—	—	—	—	—	—	280	—
30 days after transplanting seedlings	T_1	8.94	—	60.62	19.69	30.76	3.88	33.5	54.29	—
	T_2	8.75	—	59.3	18.02	27.35	2.76	40.13	77.14	—
	T_3	8.47	—	58.78	17.98	25.69	3.03	41.75	122.86	—
C.D. at 1%		N.S.	—	N.S.	N.S.	N.S.	N.S.	N.S.	39.44	—
C.D. at 5%		N.S.	—	N.S.	N.S.	N.S.	0.48	N.S.	28.28	—
Prior to second application of carbofuran	T_1	8.97	1.24	70.57	15.72	62.8	5.86	39.5	50.0	—
	T_2	9.2	1.45	66.91	13.5	58.74	3.65	43.87	63.75	—
	T_3	8.87	1.14	66.94	13.35	53.75	4.04	30.79	119.03	—
C.D. at 1%		N.S.	N.S.	N.S.	N.S.	N.S.	1.07	N.S.	45.33	—
C.D. at 5%		N.S.	N.S.	N.S.	N.S.	N.S.	—	N.S.	32.96	—
Prior to harvesting	T_1	1.46	8.55	79.37	—	55.5	2.56	11.87	121.25	—
	T_2	1.18	8.25	77.92	—	40.83	2.0	22.87	240.0	—
	T_3	0.88	8.91	78.46	—	41.15	1.95	18.0	215.0	—
C.D. at 1%		0.03	N.S.	N.S.	—	3.48	N.S.	N.S.	N.S.	—
C.D. at 5%		0.02	0.09	N.S.		2.51	N.S.	N.S.	53.19	—
Post harvesting	T_1	—	—	—	—	—	—	—	—	2.51
	T_2	—	—	—	—	—	—	—	—	2.01
	T_3	—	—	—	—	—	—	—	—	2.05
C.D. at 1%										N.S.
C.D. at 5%										N.S.

Loss in yield (%) $T_2 = 19.22$ $T_3 = 18.33$

*Mean of eight replications

the decline in the yield from T_2, T_3 and T_4 subplots has been considered as loss due to *H. gracilis*.

The loss has been assessed 12·05%, 13·61% and 12·05% in T_2, T_3 and T_4 subplots respectively.

The results of the second experiment conducted in 1981 have been analysed in Table II and III. The seed bed results have been furnished in Table II which show that the rice root nematode population in soil and root declined 41·18% and 62·96% respectively. In general, the seedlings from treated seed bed were healthier than the untreated seed bed.

Table III analyses the results from the main field. The results obtained from first sampling (30 days after transplanting), 2nd sampling (prior to second application of carbofuran granules) and 3rd sampling (prior to harvesting) are not discussed just to avoid the repeatition. Finally the grain yield was noted and it was found that T_1 subplots (main field treated with carbofuran granules, seedlings from treated seed bed) gave better yield than T_2 and T_3 subplots in which the loss has been calculated 19·22% and 18·33% respectively.

Acknowledgements

We are thankful to Dr. B. K. Tikader, Director, Zoological Survey of India, Calcutta for providing research facilities. Thanks are due to the authorities of Chinsurah Rice Research Station for alloting the field in which the experiment was conducted and also for their co-operation during the course of investigations. The financial assistance from the I.C.A.R. under the All India Co-ordinated Research Project on Nematode pests, is also acknowledged.

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THE STUDY ON SEASONAL VARIATION IN THE POPULATION OF *HIRSCHMANNIELLA GRACILIS* (de MAN, 1880) LUC & GOODEY, 1963 (TYLENCHIDA : NEMATODA) AT HOOGHLY, W. BENGAL (INDIA)

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INTRODUCTION

The seasonal variation in the population of plant and soil nematodes caused by various external influences have been discussed by many workers like Oostenbrink (1960), Seinhorst (1967, '68'), Ferris and Bernard (1967), Wallace (1969), Brodie *et al* (1970a, '70 b, '70 c), Khan *et al* (1971), Szczygiel and Hasior (1972), Chaturvedi and Khera (1979), Ahmad and Jairajpuri (1982), and others. However, our knowledge is very meager on this aspect about the rice root nematodes (*Hirschmanniella* spp.)

The qualitative and quantitative studies of nematodes associated with paddy crop at Burdwan district (W. Bengal) made by Baqri *et al.* (1983) have revealed that *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 is the most abundant and dominant species in the area surveyed. During a random survey of paddy crop at Chinsurah, district Hooghly (W. Bengal) the same species was found dominant over the other parasitic nematodes. Furthermore, Ahmad *et al.* (in press) have also confirmed the loss of yield in rice crop due to *H. gracilis*. Hence, the study on the seasonal variations in the population of this species is of great importance.

The present investigations were initiated in June, 1978 in a field managed by Chinsurah Rice Research Station, district Hooghly (W. Bengal). The entire farm has been in cultivation for over 20 years only with rice. The selected field has clayey-loam texture of soil. The two

crops of paddy are grown regularly in a year, i.e. monsoon or 'Aman paddy' and winter or 'Boro paddy'. The seedlings of monsoon paddy are transplanted in August and the crop is harvested in the first half of December. The winter paddy remains in the field from February to May.

The rainfall is very common in West Bengal from June to October. The temperature ranges from 10°—40°C in different seasons. The field always remains either saturated or submerged with irrigated water from deep tube well, except when the field is left fallow between two crops.

MATERIALS AND METHODS

The field of 75 × 25 m. was divided into 8 subplots. Soil samples were collected at monthly interval from 5 different spots in each subplot (40 subsamples). Each subsample was taken at the depths of 0 – 10 cm in 5 sq. cm. area. These subsamples were bulked together and brought to the laboratory in polythene bags. The soil was mixed thoroughly and 200 ml soil was taken from the bulk of the sample and processed by modified Bearmann funnel technique for the extraction of nematodes. After 24 hours, the larval and the adult population of *H. gracilis* were counted thrice separately and the mean was obtained. The other nematodes (*Helicotylenchus*, *Ditylenchus*, *Tylenchorhynchus*, dorylaimids and rhabditids etc.) were counted under the heading 'Other nematodes'.

Since the larvae of *H. gracilis* invade the roots of paddy, the roots were also collected on the day of soil sampling. The nematodes from roots were recovered by placing 5 gm chopped roots through blender over Bearmann funnel.

RESULTS

Soil population (Fig. 1) : The adult and larval populations were counted separately.

Adults : During March, 1979 when the winter crop of paddy was about one month old, the adult population was found reasonably low (30/200 ml soil). Then a continuous increase in the following months from April led to the highest peak in June (50, 100 and 140 in April,

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MATERIALS AND METHODS

The field of 25 × 25 m. was divided into 8 subplots. Soil samples were collected at monthly interval from 5 different spots in each subplot (40 subsamples). Each subsample was taken at the depths of 0 – 10 cm in 5 sq. cm. area. These subsamples were bulked together and brought to the laboratory in polythene bags. The soil was mixed thoroughly and 200 ml soil was taken from the bulk of the sample and processed by modified Bearmann funnel technique for the extraction of nematodes. After 24 hours, the larval and the adult population of *H. gracilis* were counted thrice separately and the mean was obtained. The other nematodes (*Helicotylenchus*, *Ditylenchus*, *Tylenchorhynchus*, dorylaimids and rhabditids etc.) were counted under the heading 'Other nematodes'.

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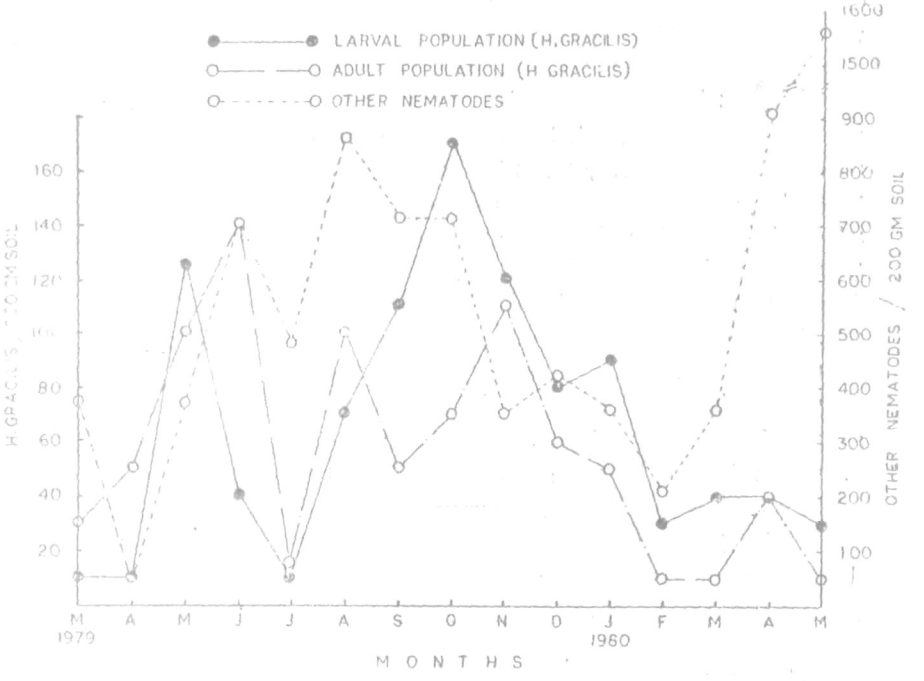

Fig I Seasonal variation in the population of *Hirschmanniella gracilis* (adults, larvae) and other nematodes in soil.

May and June respectively). The crop had been harvested in the last week of May. In July the ploughing of the field resulted in a sharp decline of adult population (15). During the month of August a marked increase was noted (100) just before the seedlings were transplanted. The post-transplanting sampling in the first week of September showed a sudden decline in the population (50) which was about half of the August. The adult population started increasing in October (70) and a second high build-up was noted in November (110). The second peak was followed by a decline in December (60) when the crop was in the last stage. The post-harvesting sampling in January, 1980 showed a slight decline (50). The ploughing in February brought down the adult population at the lowest level (10) which remained same in the first week of March even after transplanting the seedlings. The increase in April (40) was surprisingly followed by a sudden decline in May. This

decline was unlike the results obtained during April and May, 1979 when the population showed an upward trend.

Larvae : The larval population was found very low (10/200 ml soil) during March and April, 1979. This minimum population showed a sudden increase in May (125) but in June it decreased sharply (40) while the adult population was at its highest The ploughing of field in July adversely affected the larval population (10) while in August the conditions were favourable for the high build-up (70) like adult population. The population continued to increase in September (110) and it was noted more than double of the adult population. The highest peak was recorded in October (170) when the larval population became about 2.5 times the adult population. After this high build-up, the population started decreasing in November and December (120 and 80 respectively). A marginal increase was noted in January, 1980 but it was followed by a sharp decline in February after the field was ploughed. From March-May, the larval population remained almost static (30–40) The decline in the larval population from December-May has been noted more or less parallel to the adult population.

Root populations (Fig. II) : The larvae and adults of *H. gracilis* recovered from roots have been counted as root population.

In March, 1979 when the winter crop was about three weeks old, only 7 Nematodes/5 gm roots were recovered but in April this number increased six time (42), During May, at thelast stage of crop, about 1/4th population reduced in the roots (30). Though the harvestation had been completed in last week of May but in July the roots became green due to heavy rain fall and 5 gm roots yielded 9 nematodes.

The seedlings of monsoon paddy were transplanted in August and in September 35 nematodes were counted from 5 gm roots. It was observed that more nematodes invaded roots in the following two months (49 and 67 in October and November respectively). In December, just prior to harvesting, this population decreased considerably (36) and in January the post-harvesting sampling of degenerated roots also showed nearly the same level of population (38).

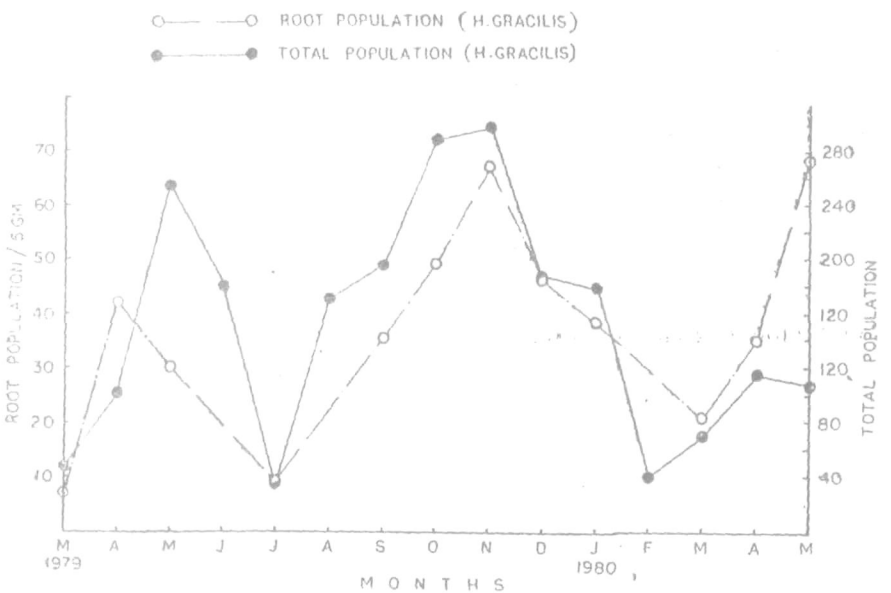

Fig II. Seasonal variation in the total population and root population of *Hirschmanniella gracilis*.

The same pattarn of nematode invasions of roots was noted in the winter paddy during March, April and May, 1980 (21, 35 and 68 respectively).

Total population (Fig II) : This is to give the general idea of the total population of *H. gracilis* in the field which included the adults and larvae from soil as well as from roots.

The total population was low (47) in March, 1979 but became more than double of it in April (102). A high build-up noted in May (255) was followed by a sharp decline in June and july (180 and 34 respectively) when the field remained fallow. The population again increased gradually from August—November (170, 195, 289 and 297 respectively). The highest peak in November was followed by sharp decline in December (186). Further decline was observed in January and February, 1980 (178 and 40) when the field was left with dry roots and stubbles. The post-

transplanting sampling again confirmed the increase in March and in the following two months (71, 115 and 108 in March April and May).

Other nematodes (Fig. I) : The other species belonging to different groups (tylenchids. dorylaimids and saprophagous) were considered less significant either because of their nonparasitic nature or less number. In view of this fact, the *Helicotylenchus* sp. and *Tylenchorhynchus* sp. were also included under this group despite their parasitic nature.

During May-December, 1979, the distinct peak of population was observed in August (860/200 ml soil). The second high build-up was found more distinct in April and May, 1980 when the population touched new peaks (910 and 1560 respectively). The results obtained in 1979 during April and May showed the populatton reasonably low but the highest build up in 1980 during the same months could not be explained in the present study.

DISCUSSION

The present study confirms that the population level of *H. gracilis* associated with paddy fluctuates in different seasons The seasonal rhythm and the presence/absence of host plants play more important role than the environmental factors because there are no extreme climatic changes in the area selected for the present study.

The adults and larval populations in soil fluctuate nearly in the similar fashion except in June and September–October. Though in June the adult population was found at highest peak but the larvae were at low level. This may easily be explained by assuming that nonavailability of host plants and the high temperature in June adversely affected the larval population and increase in the adult population happened because some larvae attained maturity during the same period. The above mentioned factors combined with the ploughing of the field during July resulted in the sharp decline of adult population along with further decrease in the larval population. The low level in the adult and larval populations during February, about one month after harvesting winter crop, further confirms that the nonavailability of host and ploughing of the field always bring down the *Hirschmanniella* population to a low level. These observations also prove the host specificity of *H. gracilis*.

The low number of nematodes recovered from roots during the first 2-3 weeks of crop and later a gradual increase in the root population prove the direct correlation with the developement of the root system. The maximum population was encountered during the flowering periods of both crops when the root system becomes highly developed. The root population immediately comes down when the roots start degenerating just before the crop is harvested, because of advance age. This observation agrees with the findings of many workers working on different crops (Wihmut, 1957; Mukhopadhyay and Prasad, 1968; and Szczygiel and Hasior, 1972).

On the basis of the high build-up of larval population and occurrence of gravid females, the breeding season has been considered from September-November Mathur and Prasad (1972) have also reported from North India that the gravid females of *H. oryzae*, occur during September which is the peak period of growth of paddy. They have also reported one generation in a year.

As reported by Wallace (1963) on *H. oryzae*, our results on the total population also agrees that *H. gracilis* is also tolerant to saturated moisture conditions. This view may be supported by the fact that the high build-up in the total poulation has always been noticed when the field remains saturated either because of irregation or the rain fall (May, October and November).

SUMMARY

Baqri *et al* (1983) and Ahmad *et al* (in press) have reported that *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 is the most abundant, dominant and serious pest of paddy crop in major rice producing districts of W. Bengal. In view of these facts, the present study was initiated in a paddy field at Chinsurah Rice Research, Station Hooghly, West Bengal. The data collected regularly at monthly interval from March 1979 to May 1980 is presented. The adults and larvae were counted separately from soil. The root population was also observed.

The adult and larval population in soil were at the lowest in July and February when the field remained fallow. The larval population

increased gradually in soil from August to October while the adult population was about half of the former population during September and October. In November, a high build-up was noted in adult population. As soon as the seedlings were transplanted, the adults and larvae invaded the roots. Their maximum number has been counted about a month before harvesting the crop. Hence, it is, evident that the nematode population in the roots is positively correlated with the development of root system of host plant. On the basis of high build-up of juvenile population, the breeding period of this nematode is from September to November.

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We are thankful to the Joint Director, Entomologist and Farm Superintendent of Chinsurah Rice Research Station, Chinsurah, Hooghly, W. Bengal for allowing us to conduct the present study and also for their co-operation during the course of investigation. Thanks are due to Dr. B.K. Tikader, Director, Zoological Survey of India, Calcutta for providing research facilities. The financial assistance from I.C.A.R is also acknowledged.

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EFFECT OF DIFFERENT SOURCES OF NITROGEN ON THE MANAGEMENT OF *HIRSCHMANNIELLA GRACILIS* (DE MAN, 1880) LUC & GOODEY, 1963 (TYLENCHIDA : NEMATODA) ASSOCIATED WITH PADDY CROP

BY

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ABSTRACT

The present study reveals that the application of ammonium sulphate, calcium ammonium nitrate and fresh chopped leaves of water hyacinth decreases the population of rice root nematode, *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963, and improves the general health of rice plants. As a result the paddy yield also increases. Water hyacinth appears to be more effective than the inorganic fertilizers (ammonium sulphate and calcium ammonium nitrate) in the management of *H. gracilis*.

INTRODUCTION

In recent years, due to the awareness of pollution and health hazards caused by the application of pesticides in the agricultural fields, sincere efforts have been made to evaluate nematode control methods like crop rotation, development of resistant crop varieties, modification of soil environment with organic and inorganic matters, etc. The nematicides are too expensive and an average Indian farmer will not be able apply these in the fields. Under these circumstances, it has become necessary to find out cheaper and simplermethods of controlling nematodes. The application of nitrogen fertilizers is an

effective method for the control of plant parasitic nematodes (Miller & Wihrheim, 1966; Johnson, 1971; Gour & Prasad, 1970; Mishra, 1972; Mishra & Prasad, 1972; Vijaylakshmi & Prasad, 1982; etc.). The modification of soil environment with chopped plant parts has also been reported to be effective (Singh & Sitaramaiah, 1967; Roy, 1970; Haseeb et. al., 1978; Roy, 1979; Nath et al., 1982; Ram & Gupta, 1982; Jain & Hasan, 1984; Haseeb & Alam, 1984; Alam, 1986; etc.).

The present study was undertaken to assess the effect of different sources of nitrogen, ammonium sulphate, calcium ammonium nitrate and chopped leaves of water hyacinth on the management of rice root nematode, Hirschmanniella gracilis. The water hyacinth was chosen because it is an unwanted weed in Indian ponds having tremendous power of growth and reproduction.

MATERIAL AND METHODS

The present investigations were initiated in July 1985 at village Rautara, district 24-Parganas, West Bengal. The initial population of H. gracilis was found to be significant in the experimental field. The field was divided into 24 subplots (4 x 4 m each) which were separated from each other by 0.5 m bund. One month old seedlings of 'Jay' variety of rice were transplanted in the first week of August 1985 at 15 x 20 cm distance. Recommended cultural practices were followed. No other pesticides or weedicides were applied during the course of investigations.

The following four treatments were replicated six times and randomised (6 x 4 = 24 subplots):

T_1 = Untreated control,

T_2 = Application of ammonium sulphate @ 60 kg/ha,

T_3 = Application of calcium ammonium nitrate @ 60 kg/ha,

T_4 = Application of fresh chopped leaves of water hyacinth @ 19.2 kg/subplot.

The water hyacinth leaves were incorporated in the subplots only a day before transplanting the seedlings. The native population of *H. gracilis* was also counted on the same day. Sampling was made twice, i.e., on 50th day after transplanting the seedlings and two days before harvesting the crop. On each sampling date, 10 plants were rooted out at random from each subplot to note the length of roots and shoots (cm), weight of total plant and roots separately (gm) and also the *H. gracilis* population in gm roots. Besides, the soil samples were also collected from five spots at random from each subplot. *H. gracilis* population was estimated per 200 ml soil from each subplot. The estimation of roots and soil populations of *H. gracilis* was done as described by Baqri *et al.* (1983).

The experiment was repeated in the same experimental field with the same layout during the monsoon season in 1986 to confirm the results obtained in 1985.

RESULTS

All the results obtained during 1985 and 1986 have been furnished in Table I - III. Table I deals with the results of Hirschmanniella gracilis population. It reveals that the application of inorganic fertilizers and the water hyacinth brings down the population of H. gracilis significantly in soil as well as paddy roots in T_2, T_3 and T_4 subplots. The chopped leaves of water hyacinth appear to be more effective than fertilizers because the maximum reduction in H. gracilis population has been noted in T_4 subplots. In these subplots the average reduction in soil population has been noted 54% and 44.5% on the first sampling date (30th day) while 56% and 39.5% on second sampling date (before harvesting) in 1985 and 1986. This reduction was further confirmed by the estimation of root population. Though the root population in T_2 and T_3 subplots was found lower than untreated/control but the lowest population was counted from roots of the plants grown in water hyacinth treated subplots. The reduction in T_4 subplots was observed 35.8-62.4% on the first sampling date and 37.8-57.2% on second sampling date in 1985 and 1986.

Table II deals with the results on plant growth. It may be concluded from the results furnished in this table that the length of roots and shoots does not increase significantly in the treated subplots. However, the increase in the weight of roots and plants was significant in T_2, T_3 and T_4 subplots over T_1 subplots, except the roots in T_2 and T_3 subplots during 1986

on first sampling date. This increase was found due to the well developed root system and greater number of tillers in the plants grown in the treated subplots. The application of fresh water hyacinth chopped leaves increased the root weight significantly, i.e., 31.5-34.8% on first sampling date and 34.7-46% on second sampling date in 1985 and 1986. The maximum weight of the total plants was also noted from water hyacinth treated subplots. The increase was about 38% on first sampling date and 19.5-28.8% on second sampling date.

Table III provides the yield results obtained in 1985 and 1986. It is evident from the table that the yield increased significantly due to the application of ammonium sulphate (T_2), calcium ammonium nitrate (T_3) and fresh chopped leaves of water hyacinth (T_4). The increase was respectively noted 10-14.7%, 16-17.2% and 27.2-29%. The maximum average paddy yield was obtained from T_4 subplots.

DISCUSSION

Our results conclude that the organic amendments greatly influence the nematode population and significantly increase the plant growth. Improvement in plant growth and yield is linearly correlated with the application of water hyacinth. This is not clear whether these improvements resulted directly due to the reduction in H. gracilis population in roots or to physiological effects on paddy plants or to the soil nutrient

status. Van der Laan (1956) expressed that the organic soil amendments increase the host resistance while Khan *et al.* (1974) have explained that the toxicity of decomposing products of organic additives helps to control the plant parasitic nematodes. Mankau and Das (1974) suggested the following five possible reasons for the reduction of plant parasitic nematodes by adding the organic materials to the soil: antagonistic microbial activity, by products of decomposition or toxic metabolites of organisms, unfavourable environmental conditions, increased host vigor, and specific organic amendment can supress specific nematode.

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TABLE - I

EFFECT OF DIFFERENT SOURCES OF NITROGEN IN THE MANAGEMENT OF *Hirschmanniella gracilis*.

Treatment	Year	*H. gracilis* population in soil		*H. gracilis* population in root		Reduction in *H. gracilis* population (%) soil		Reduction in *H. gracilis* population (%) root	
		1	2	1	2	1	2	1	2
T_1	1985	196.6	171.6	155.0	116.6	-	-	-	-
	1986	391.6	110.0	251.6	115.0	-	-	-	-
T_2	1985	40.0	133.3	113.3	86.6	80.0	23.0	27.0	25.6
	1986	263.3	83.3	188.3	93.3	32.8	24.3	26.0	18.9
T_3	1985	113.3	115.0	146.6	83.0	43.4	33.0	5.5	28.0
	1986	268.3	90.0	245.0	88.3	31.5	18.2	6.2	23.3
T_4	1985	90.0	76.6	53.3	50.0	54.1	56.0	62.4	57.2
	1986	221.6	66.6	168.0	71.6	44.5	39.5	35.8	37.8

Each value is an average of six replicates
1 on 50th day
2 two days before harvesting

T_1 = Untreated (Control) treatment
T_2 = Ammonium sulphate treatment
T_3 = Calcium ammonium nitrate treatment
T_4 = Water hyacinth treatment.

TABLE - II

EFFECT OF DIFFERENT SOURCES OF NITROGEN ON THE PLANT GROWTH

Treatment	Year	Root length (cm)		Shoot length (cm)		Root weight (gm)		Increase/ Decrease in root weight (%)		Plant weight (gm)		Increase/ Decrease in plant weight (%)	
		1	2	1	2	1	2	1	2	1	2	1	2
T_1	1985	18.9	10.9	60.3	77.6	7.6	4.6	-	-	39.3	34.7	-	-
	1986	17.8	16.5	57.0	75.8	8.9	7.6	-	-	35.0	46.5	-	-
T_2	1985	18.9	10.7	62.3	79.1	9.1	5.6	+19.7	+21.7	41.3	34.7	+5.0	
	1986	17.7	16.6	57.4	76.2	8.2	8.1	-7.9	+6.5	37.1	49.9	+6.0	+7.3
T_3	1985	17.9	11.0	64.2	79.9	8.2	5.2	+7.8	+13.0	44.6	35.3	+13.4	+1.7
	1986	19.5	18.0	57.9	78.2	8.7	8.4	-2.3	+10.5	37.9	53.4	+8.0	+14.8
T_4	1985	18.0	11.4	66.2	81.5	10.0	6.2	+31.5	+34.7	54.4	41.5	+38.4	+19.5
	1986	18.8	18.4	60.2	80.2	12.0	11.1	+34.8	+46.0	48.3	59.9	+38.0	+28.8

\+ Increase

\- Decrease

TABLE - III

EFFECT OF DIFFERENT SOURCES OF NITROGEN ON PADDY YIELD

	1985	Increase	1986	Increase
T_1	3.931 kg		3.883 kg	-
T_2	4.511 kg	14.7%	4.280 kg	10%
T_3	4.564 kg	16%	4.554 kg	17.2%
T_4	5.002 kg	27.2%	5.012 kg	29%

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